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PHYSICS ABSTRACTS

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Physics Abstracts

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PHYSICS ABSTRACTS

Volume 60 FEBRUARY 1957 Number 709

MATHEMATICS 51

517.3

995. THE EVALUATION OF INTEGRALS CONTAINING A PARAMETER. R.B.Dingle.
Appl. sci. Res. B, Vol. 4, No. 6, 401-10 (1955).

A number of methods for obtaining expansions and approximations to an integral containing a parameter are expounded, and each illustrated by evaluating the function $Ei_n(x) = \int_1^\infty u^{-n} e^{-xu}\, du$. A.

517.3

996. THE INTEGRALS $Ci_n(x) = \int_1^\infty u^{-n} \cos ux\, du$ AND $Si_n(x) = \int_1^\infty u^{-n} \sin ux\, du$ AND THEIR TABULATION.
R.B.Dingle.
Appl. sci. Res. B, Vol. 4, No. 6, 411-20 (1955).

The properties and applications of the integrals $Ci_n(x)$ and $Si_n(x)$ are discussed, and various expansions developed. The functions are tabulated to six decimals for integer values of n up to six and for values of x = 0 (0.1) 1 (0.2) 5 (0.5) 20. A.

517.3

997. TABLES OF THE INTEGRALS

$$CI_n(x) = \int_1^\infty u^{-n}(1-u^{-2}) \cos ux\, du \text{ AND}$$
$$SI_n(x) = \int_1^\infty u^{-n}(1-u^{-2}) \sin ux\, du.$$

R.B.Dingle.
Appl. sci. Res. B, Vol. 4, No. 6, 421-4 (1955).

The integrals $CI_n(x)$ and $SI_n(x)$, required in the theory of the anomalous skin effect and optical properties of metals, are tabulated to six decimals for integer values of n up to four and for values of x = 0 (0.1) 1 (0.2) 5 (0.5) 20. A.

517.9

998. THE METHOD OF COMPARISON EQUATIONS IN THE SOLUTION OF LINEAR SECOND-ORDER DIFFERENTIAL EQUATIONS (GENERALIZED W.K.B. METHOD). R.B.Dingle.
Appl. sci. Res. B, Vol. 5, No. 5, 345-66 (1956).

Linear second-order differential equations with known solutions are classified according to the form of the "comparison function" $\Gamma(\sigma) = U^{-1}(\sigma)d^2U(\sigma)/d\sigma^2$. It is shown that the solutions u(x) of another such equation $\gamma(x) = u^{-1}(x)d^2u(x)/dx^2$ may be expressed in terms of the known solutions $U(\sigma)$ by the relation $u(x) = (d\sigma/dx)^{-1/2}U(\sigma)$ where $\sigma(x)$ is given by the general fundamental equation

$$\gamma(x) = (d\sigma/dx)^2\Gamma(\sigma) + (d\sigma/dx)^{+1/2}.(d^2/dx^2)(d\sigma/dx)^{1/2}.$$

When the last ("correction") term in this equation can be neglected, $\sigma(x)$ may be found directly; as particular cases, the ordinary W.K.B. solutions result when the comparison function chosen is $\Gamma(\sigma) = 1$, and the Langer solutions when $\Gamma(\sigma) = \sigma$. Tables are provided of the four functions in terms of which the Langer solutions can most easily be expressed. It is shown how the approximate solution of the general fundamental equation relating σ to x may be employed in a perturbation method which avoids the customary — and sometimes dubious — assumption that all perturbed functions may be expanded by straightforward Taylor series involving only integral powers of the perturbation parameter. Finally, it is shown how the correction term in the general fundamental equation may be evaluated. Explicit expressions are obtained for the correction terms to the ordinary W.K.B. solutions and to the Langer solutions. A.

517.9 : 538.3

999. ON THE CLASSIFICATION OF THE ORDINARY DIFFERENTIAL EQUATIONS OF FIELD THEORY. P.Moon and D.E.Spencer.
Quart. appl. Math., Vol. 14, No. 1, 1-10 (April, 1956).

The equations arise from the solution of the Laplace and Helmholtz equations by the method of separation of variables. It is shown that equations obtained by separation of variables in 40 coordinate systems may be reduced to 19 distinct equations of the Bôcher type possessing poles of orders $m_1, m_2, \ldots m_{n-1}$ and a pole of order m_n at infinity. It is noted that, contrary to statements in the literature, not all of these equations may be derived from equations for which

$$\sum_{i=1}^{n} m_i = 5.$$

R.A.Newing

517.947

1000. EXPRESSION OF WAVE FUNCTIONS OVER A HALF-SPACE IN TERMS OF THEIR BOUNDARY VALUES.
H.Poritsky.
Quart. appl. Math., Vol. 14, No. 2, 185-97 (July, 1956).

Solutions of the wave equation in the half-space $z > 0$ are expressed as surface integrals, over the boundary z = 0, involving [u], $[\partial u/\partial t]$ and $[\partial u/\partial z]$, and the formulae are applied to axially symmetric solutions and to plane and spherical waves. The results are extended to n-dimensional space.
R.A.Newing

518.5 : 539.172.4

1001. SOLUTION OF THE MULTI-GROUP NEUTRON DIFFUSION EQUATIONS ON A DIGITAL COMPUTER. A.Hassitt.
Atomic Energy Res. Establ. (Harwell) Rep. No. T/R 1904, 15 pp. (1956).

A programme has been devised, which will solve the two-group diffusion equations for a homogeneous cylindrical reactor with reflectors, on a Ferranti Mark 1* computer. The differential equations are replaced by finite difference equations, which are solved by an iterative (extrapolated Liebmann) process. The programme computes k and the neutron fluxes. A short account is given of the setting up of the finite difference equations, the theory of the iterative process, and the estimation of the errors due to the use of a finite mesh size. The computer takes 1 msec to add together two twelve decimal numbers, and 2 msec to multiply them together. The programme takes about one hour to compute the fluxes (with 1% accuracy) and k, for a mesh of 700 points. A.

518.5

1002. SOLUTION OF ALGEBRAIC EQUATIONS ON AN ANALOG COMPUTER. C.R.Cahn.
Rev. sci. Instrum., Vol. 27, No. 10, 856-8 (Oct., 1956).

A method has been found for solving an algebraic equation for a real or complex root on an analogue computer (electronic differential analyser). The computer connections are arranged so that the root locations may be shifted along the real axis of the complex plane by adjusting a ganged potentiometer. A maintained transient is indication that a root has been shifted to the imaginary axis, allowing the real and imaginary parts of the root to be read. The accuracy is reduced when a second nearby root is present; however, poor tracking in the ganged potentiometer has about the same effect as an improper setting of a coefficient of the equation. A.

518.5 : 539.172

1003. MECHANICAL PHASE ANALYSERS FOR TREATMENT OF EXPERIMENTAL DATA ON SCATTERING OF SPINLESS PARTICLES BY PARTICLES OF SPIN 0 OR ½.
N.P.Klepikov.

Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1155-8 (1956). In Russian.

The $\exp(2i\delta_l^{\pm})$, where $\delta_l^{\pm}$ are the phase shifts, are viewed as vectors on a plane, and quantities derived from the cross-section and polarization determine the absolute values of certain linear combinations of these vectors. G.E.Brown

518.5 : 535.33.087.9

THE USE OF HOLLERITH COMPUTING MACHINES IN SPECTROSCOPIC TERM ANALYSIS. See Abstr. 1174

519.2

1004. ON THE AVERAGE UNCERTAINTY OF A CONTINUOUS PROBABILITY DISTRIBUTION. A.D.du Mosch.
Appl. sci. Res. B, Vol. 4, No. 6, 469-73 (1955).

The concept of uncertainty plays an important role in the theories of information and communication. The average uncertainty $H(P_i)$ in the occurrence of one out of n possible events shows a better agreement with intuitive concepts if compared with the average uncertainty H(x) of a continuous probability distribution. In this paper, physical considerations play a part in obtaining a measure of uncertainty which agrees better with intuition when applied to continuous probability. A.

519.24

1005. CONDITIONAL MONTE CARLO. J.M.Hammersley.
J. Assoc. Comput. Mach., Vol. 3, No. 2, 73-6 (April, 1956).

The expected value of a function $\varphi(x_1, x_2 \ldots x_n)$ of random variables $x_1, x_2 \ldots x_n$ with a joint distribution function $f(x_1, x_2 \ldots x_n)$ may be evaluated as the expected value of $\varphi(x_1, x_2 \ldots x_n)x_i = x_i(z_1, \ldots z_m + n) \cdot w(z_1, \ldots z_m + n)$ where $z_1, z_2 \ldots z_m + n$ have a joint distribution $h(z_1, \ldots z_m + n)$. It is sometimes possible to arrange the transformation from (x) to (z) in such a way that the second expectation is more accurately estimated by sampling than is the first.

N.L.Johnson

ASTRONOMY . ASTROPHYSICS . GEODESY 52

523.038 : 550.38

1006. ON COWLING'S THEOREM ON THE IMPOSSIBILITY OF SELF-MAINTAINED AXISYMMETRIC HOMOGENEOUS DYNAMOS. G.E.Backus and S.Chandrasekhar.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 3, 105-9 (March, 1956).

The theorem is extended to the case in which magnetic lines of force and fluid motion are not confined to meridional planes, toroidal fields and rotational fluid motion being allowed. R.A.Newing

523.112

1007. DISTURBANCES IN AN EXPANDING UNIVERSE. J.B.Helliwell.
Ann. Astrophys., Vol. 19, No. 1, 19-33 (1956).

The powerful perturbation methods of Lifshitz are employed to obtain the dispersion equations for disturbances of harmonic type in universes of general curvature composed of a uniform distribution of gravitating material. An examination of these equations then verifies the simple result that, in static spaces of positive curvature, the surface of a sphere may differ by as little as we please from its tangent plane at a point halfway to the antipodal point of the centre, but that no such limiting position exists in spaces of negative curvature, in contrast with the classical result where the limiting position is at infinity. An extension of these results is also obtained for the case of non-static universes. Expressions are also derived to give a measure of the tendency of local disturbances towards instability in various models of the universe. A.

523.161

1008. INTERSTELLAR POLARIZATION. W.A.Hiltner.
"Vistas in Astronomy", Volume II, 1080-91, See Abstr. 10 (1957).

Arguments are presented that the observed polarization of radiation is of interstellar origin. The change with galactic longitude of the character of the observed polarization is explained in terms of our present knowledge of galactic structure. Evidence is presented that a relationship exists between the observed polarization and the visible obscuring material. A new ratio of polarization to visual absorption is given, $p = 0.054\ A_V$. The strength of the magnetic field that aligns the particles is shown to have a field strength of the order 2×10^{-5} gauss. The future aspects of observational polarization work are discussed. A.Beer

523.161

1009. THE KINETIC TEMPERATURE OF THE INTERSTELLAR GAS IN REGIONS OF NEUTRAL HYDROGEN. M.J.Seaton.
Ann. Astrophys., Vol. 18, No. 3, 188-205 (1955).

Mainly concerned with the cooling resulting from excitation by electron impact of low-lying levels in C^+, and Si^+, and Fe^+. The collision cross-sections have been calculated by quantal methods for C^+ and have been estimated for Si^+ and Fe^+; the precision of the results obtained should be adequate for the present problem. The chemical composition of the gas is assumed to be similar to typical stellar compositions; this assumption is shown to be reasonable but it is not established with certainty. The cooling rate due to electron-ion collisions is found to be comparatively large and it would appear that purely local heating mechanisms, such as photo-ionization, are inadequate to maintain the temperature of 125°K deduced from 21 cm line observations. Kahn has suggested that a powerful heating mechanism may be provided by collisions between the gas clouds. This mechanism implies large temperature variations; it has been shown by Kahn that the temperature of 125°K should then be regarded as a harmonic mean temperature. Adopting Kahn's estimate of 3000°K for the temperature produced in cloud collisions it is calculated that the cooling time required to give a harmonic mean temperature of 125°K is about 10 million years. This is in good agreement with the estimated average time between cloud collisions. Thus if the adopted abundances are correct the observed temperature can be reconciled with cloud-collision heating without invoking cooling by H_2 molecules. The arithmetic mean temperature obtained is of order 1000°K; for cooling by molecules it would be somewhat smaller. A.

523.162

1010. THEORIES OF INTERSTELLAR POLARIZATION. L.Davis, Jr.
"Vistas in Astronomy", Volume I, 336-44. See Abstr. 10 (1957).

The expression for the ratio of polarization to absorption produced by a cloud of partially aligned small dust grains is put in a form applicable to all current theories of alignment. A semi-quantitative treatment is given of Gold's proposal that alignment is due to relative motion of dust through gas, and this mechanism is shown to be inadequate to produce the observed polarization. Magnetic alignment theories are preferred. Equations are given for use when star-light passes through several clouds with various orientations. Any orienting mechansim can be tested by a statistical study of the observed distribution of polarization over neighbouring stars. Thus it appears tentatively that it is more plausible to assume that a galactic magnetic field lies along a spiral arm than that the field is randomly directed in the plane of the Galaxy. A.Beer

523.164

1011. THE ASTRONOMICAL PROGRAMME OF THE BONN RADIO TELESCOPE. F.Becker.
Telefunken Ztg, Vol. 29, 148-52 (Sept., 1956). In German.

523.164.32

1012. RADIO-FREQUENCY OBSERVATIONS OF THE SOLAR ECLIPSE OF JUNE 30, 1954. G.Eriksen, Ø.Hauge, and E.Tandberg-Hanssen.
Astrophys. Norveg., Vol. 5, No. 4, 131-52 (Aug., 1955).

Radio-frequency power received from the sun at wavelengths of 60 cm and 1.5 m was measured during the solar eclipse of June 30, 1954. The sun was essentially free from active areas, and the eclipse curves obtained have been used to derive models of the radio sun at the two wavelengths.

These models give predicted eclipse curves in good agreement with the observed ones. Comparison has been made with models derived by other investigators on the same wavelengths. A.

523.164.32

1013. MEASUREMENT OF THE SOLAR MILLIMETER SPECTRUM. H.H.Theissing and P.J.Caplan.
J. Opt. Soc. Amer., Vol. 46, No. 11, 971-8 (Nov., 1956).

Solar millimetre radiation, isolated by black filters, was received with a thermal detector in the focus of a 60 in. parabola. The transmission of this radiation through woven copper wire mesh of various gauge was measured. Since neither theoretical nor experimental data on the filter characteristics of mesh were available, a microwave method was used to obtain this information. The resulting filter curves together with the solar measurements made an evaluation of the millimetre spectrum possible. Also, a theoretical spectral curve was drawn multiplying Rayleigh-Jeans' λ^{-4} intensity with Van Vleck attenuation data which were computed for the atmospheric conditions during the solar measurements, but raised according to earlier experimental attenuation results of the authors. This curve was in good agreement with the measured spectrum showing that the observed short-wave cutoff near 0.9 mm is due to sharply rising attenuation; the observed peak between 1.0 and 1.1 mm lies in the predicted window, after which the spectral intensity falls off at longer wavelengths according to the λ^{-4} law. A.

523.164.4

1014. ON NON-IONOSPHERIC VARIATIONS IN THE INTENSITY OF RADIO EMISSION FROM NEBULAE. V.L.Ginzburg.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 1, 61-3 (1956). In Russian.

After disagreeing with the explanation suggested by Kraus et al. (see Abstr. 9363/1955) of their observation of a fluctuating celestial radio source, the author offers an alternative explanation involving diffraction of the signal by inhomogeneities in the ionosphere or in the solar corona. J.B.Arthur

523.164.4

1015. THE RADIO RADIATION OF INTERSTELLAR GAS AND THE PRINCIPLE OF ITS MEASUREMENT. P.Mezger and W.Priester.
Telefunken Ztg, Vol. 29, 152-6 (Sept., 1956). In German.

A brief account of the physical processes giving rise to interstellar radiation, and of the interpretation of 21 cm line contours. M.W.Ovenden

523.164.85

1016. PHASE CHANGES AND RESONANCE EFFECTS IN RADIO ECHOES FROM METEOR TRAILS. J.S.Greenhow and E.L.Neufeld.
Proc. Phys. Soc. B, Vol. 69, Pt 11, 1069-76 (Nov., 1956).

When an ionized meteor trail is studied by the radio echo technique variations in phase of the scattered wave are observed. The phase changes resulting from diffraction effects, and those caused by the orderly movement of the trail under wind forces, are well known. This paper discusses a third type of phase change which is attributed to resonance as the ionized trail expands. It is shown that the measurements are in good agreement with the phase changes predicted by the theory of the scattering of radiowaves from meteor trails. A.

523.3 : 538.566.3 : 551.510.535

1017. RADIO ECHOES FROM THE MOON. I.C.Browne, J.V.Evans, J.K.Hargreaves and W.A.S.Murray.
Proc. Phys. Soc. B, Vol. 69, Pt 9, 901-20 (Sept., 1956).

Observations of radio echoes from the moon at transit have been made from September 1953 to August 1955, using a pulsed transmitter operating at 120 Mc/s. The aerial, which is a high-gain array with a physical area of 40 square wavelengths, transmits and receives waves which are horizontally polarized. The first part of the paper discusses the theory of echoes from the moon, and includes estimates of the echo intensity and of the power spectrum of the echoes for several assumptions about the scattering function of the lunar surface. It is also shown that the ionosphere should rotate the plane of polarization of the radio waves, thus producing long-period fading of the echoes, and that the angle of rotation is a measure of the total electron content of the ionosphere. The second part of the paper presents the results of the observations. The observed echo intensity, in conjunction with the observed power spectra of the echoes, is consistent with the assumption that the moon reflects radio waves in such a way that its projected disc appears uniformly "bright", as is the case for light waves. The power reflection coefficient must be somewhat less than 0.1. The observed echoes are subject to rapid fading. This is found to be due to the moon's libration. The libration varies with the position of the moon in its orbit, causing a corresponding change in the rate of fading. Experimental proof is obtained that the slow fading of moon echoes previously reported by other workers is due to the rotation of the plane of polarization of the waves by the ionosphere. By observing the slow fading on two frequencies with a separation of 1.5 Mc/s, it is possible to measure the total angle by which the plane of polarization is rotated and hence the total electron content of the ionosphere. Some preliminary results appear to indicate that the parabolic half-thickness of the F2-region may be a more reliable measure of the extent of the ionosphere than has sometimes been supposed. A.

523.5

1018. THE NUMBER DENSITY OF METEOR TRAILS OBSERVABLE BY THE FORWARD-SCATTERING OF RADIO WAVES. R.E.Pugh.
Canad. J. Phys., Vol. 34, No. 10, 997-1004 (Oct., 1956).

The number of meteor trails which can be detected by the forward scattering of radiowaves varies with the region of the sky under observation. The number density is determined theoretically, as a function of position relative to the transmitter and receiver. A.

523.5

1019. THE SPATIAL DISTRIBUTION OF SIGNAL SOURCES IN METEORIC FORWARD-SCATTERING. C.O.Hines and R.E.Pugh.
Canad. J. Phys., Vol. 34, No. 10, 1005-15 (Oct., 1956).

The spatial distribution of observable meteor trails is determined, with the aid of the "cylindrical approximation" appropriate to forward scattering observations. Contour charts of the distribution are presented, and found to compare favourably with those obtained from a more exact analysis, presented in a companion paper (see preceding abstract). Typical effects of the signal durations are also examined. The whole is compared with an earlier development by Eshleman and Manning (1954), which treats closely related aspects of meteoric forward scattering. A.

523.5 : 550.42

ABUNDANCES OF THE ELEMENTS. See Abstr. 927

523.59

1020. NEW STUDIES ON THE POSITION OF THE ZODIACAL LIGHT IN SPACE. N.Donitch.
Bull. astron. (Paris), Vol. 20, No. 1, 15-26 (1955). In French.

43 photographs of zodiacal light were obtained on four occasions at Tamanrasset; they enabled its position in space to be found. During the time involved, the inclination on the ecliptic remained equal to $+ 1^{\circ}45'.2$, while the ascending node underwent oscillations of 33°. A.

523.67

1021. THE SPECTRA OF THE COMETS. P.Swings.
"Vistas in Astronomy", Volume II, 958-81. See Abstr. 10 (1957).

The need for "monochromatic observations" by direct photography, photometry and polarization techniques of nucleus, coma and tail of comets is emphasized. The emission spectrum of the tail, from the OH emission near λ3100 to the red CN band near λ8100, is examined, as well as the spectrum of the tail in the ultraviolet and photographic regions. The complex profile of the emission bands is shown to be due to a resonance-fluorescence excitation, taking into account the absorption lines of the exciting solar radiation. Other possible excitation mechanisms are mentioned. The probable assignment of the λ4050 group to the tricarbon molecule and its consequences are discussed. Physical considerations on the still unidentified emissions, on desirable physical investigations, on the parent molecules, on the production and evolution of cometary atmospheres, and on the densities and the extent of molecules in the cometary head are put forward. A.Beer

523.72

1022. PRESENCE OF LITHIUM, BERYLLIUM AND DEUTERIUM IN THE SOLAR ATMOSPHERE. I.S.Shklovskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 931-4 (1955). In Russian.

It is suggested that Li and Be observed in solar atmosphere might be generated in the atmosphere itself by the "solar" cosmic rays produced during flares, when these rays collide with the O- and Fe-group nuclei. The flux of cosmic rays in solar atmosphere must be of considerable magnitude because the general magnetic field of the sun inhibits their exit into interstellar space. It is to be expected that the highly "active" stars have very high values of the cosmic-ray flux; this would explain the existence of the peculiar ("lithium" type)

stars. The presence in solar atmosphere of large proportions of D has not been definitely proved; the author suggests looking for its lines in the flare spectra during solar eclipses. F.Lachman

523.746

1023. VARIATIONS IN THE STRUCTURE OF SUNSPOTS IN RELATION TO THE SUNSPOT CYCLE. E.Jensen, J.Nordø and T.S. Ringnes.
Astrophys. Norveg., Vol. 5, No. 6, 167-205 (Aug., 1955).

The ratio between the total area and the umbra area of the spots is reduced to a linear scale. The mean values of this ratio, denoted by q, are calculated for each year. Further, the dependence of the ratio q on the mean radius, p, of the spots, is studied. A statistical analysis is carried out in an effort to see whether the variations found are real. The first stage is to test the variations of the yearly mean values of q. It is found that the probability of obtaining a variation of the kind observed by chance is extremely small. The trend that variations in the inclinations of the p-q curves follow the sunspot cycle is tested for statistical significance. An effect less probable than found in the case of the periodic variations in the mean value of q is indicated. The behaviour of the recurrent spots contained in the material is investigated. For the regular spots with $p < 10 \times 10^{-3}\ R_\odot$, which are not included in the main discussion of this paper, the dependence of q on p has also been considered. A.

523.746

1024. A STUDY OF THE PENUMBRA–UMBRA RATIO OF SUNSPOT PAIRS. E.Tandberg-Hanssen.
Astrophys. Norveg., Vol. 5, No. 7, 207-27 (Jan., 1956).

The earlier work of Jensen, Nordø and Ringnes on the penumbra–umbra ratio q of isolated, regular sunspots has been extended to double and composite spots. A number of their findings has been confirmed. Results: (1) A more or less periodic variation of q with time has been found for many spots, the periods ranging from one to four or five days. (2) No dependence of q on the distance Δ between the components of bipolar spots seems to exist for $\Delta > 3^\circ$. The importance of this in connection with the study of the geometry of single spots is stressed. (3) A different behaviour of the spots in their dying-out phase in years of maximum and minimum solar activity is found and may possibly be related to the difference in the turbulent motion of the solar atmosphere at maximum and minimum epochs. (4) A marked tendency of q to fluctuate in phase with the solar activity is found. (5) The q-ratio is, as a rule, greater for composite than regular spots. The distribution of these types of spots has been investigated. A.

523.75 : 537.591.5 : 550.371 : 550.38

1025. THE COSMIC RADIATION AND SOLAR–TERRESTRIAL RELATIONSHIPS. J.A.Simpson.
Ann. Géophys., Vol. 11, No. 3, 305-29 (July-Sept., 1955).

A brief review of the properties of cosmic radiation and selected topics on the association of cosmic-ray phenomena with solar and geophysical processes. There is a description of recent experimental methods developed to study the low-energy cosmic-ray particles which have been hitherto inaccessible to continuous observation. These low-energy particles contribute to the main effects which are found to be associated with solar processes; namely, variations of primary intensity and energy. The low-energy cosmic radiation may be used to investigate, for example, the existence and limits of geoelectric fields, the magnitude of interplanetary magnetic fields, properties of solar-initiated ionic beams, and the role of solar flares in producing temporary increases of cosmic-ray intensity at the earth. A.

523.752

1026. THE CHARACTERISTIC FIGURES OF THE FLOCCULI OF HYDROGEN AND OF CALCIUM, AND THE FILAMENTS OF HYDROGEN, FOR THE YEAR 1954. G.Godoli.
Ann. Geofis., Vol. 8, No. 3, 325-9 (1955). In Italian.

523.775

1027. THE ULTRA-VIOLET AND X-RAY SPECTRUM OF THE SUN. C.de Jager.
Ann. Géophys., Vol. 11, No. 3, 330-52 (July-Sept., 1955).

Surveys present knowledge of the structure of the solar atmosphere (photosphere, transition between photosphere and chromosphere, chromosphere and corona) as deduced from observational data. Computations of the intensity of radiation in the ultraviolet and X-ray spectrum are summarized, and the following are discussed: the near ultraviolet spectrum, $\lambda > 1500$ A; the continuous spectrum between 912 and 1350 A; the intensity and profile of Ly α; the continuous emission of the corona between 10 and 900 A; the line emission of the corona in this region; the variable component of the X-ray emission. In the last section these considerations are taken together and a tentative spectrum of the sun for $\lambda < 3000$ A is given. A.

523.821

1028. MONOCHROMATIC MAGNITUDES. R.v.d.R.Woolley.
"Vistas in Astronomy", Volume II, 1095-8. See Abstr.10 (1957).

The advantages of monochromatic magnitudes are discussed and a definition of monochromatic magnitude as the average over a bandwidth of order 100 A is advocated. The advantages of photoelectric cells are compared with those of photographic plates. The hope is expressed that the standard of stellar magnitudes will change from the International Sequence to a standard expressed in terms of the metre, kilogramme, and second. A.Beer

523.877

1029. FRAUNHOFER LINES AND THE STRUCTURE OF STELLAR ATMOSPHERES. A.Unsöld and V.Weidemann.
"Vistas in Astronomy", Volume I, 249-56. See Abstr. 10 (1957).

The comparison between stellar and laboratory spectra is discussed and it is emphasized that quantitative analysis of stellar spectra must involve essentially three points: (1) spectrophotometric measurements, (2) the theory of radiative and possibly convective transfer, (3) the atomic theory of absorption coefficients. Recent developments are characterized by treating radiative transfer in spectral lines mostly according to the scheme of "true absorption" and by giving closer attention to the temperature stratification, using essentially non-grey models. The importance of more and better theoretical and laboratory work on transition probabilities, line broadening and similar concepts is stressed. The problem of damping constants in solar type stars is given special attention. A.Beer

523.877

1030. ON THE RADIAL OSCILLATIONS OF STELLAR MODELS WITH GREAT MASS CONCENTRATION. P.Ledoux.
Ann. Astrophys., Vol. 18, No. 3, 232-3 (1955). In French.

For previous part see Abstr. 5201 (1955). If τ_0 and τ_1 represent respectively the periods of the fundamental mode and of the first mode of radial oscillation, it is found that for the model with a very large central condensation but an extensive convection zone considered previously, the ratio τ_1/τ_0 for $\gamma = 5/3$, is reduced to 0.543. There is thus a possibility that the commensurability 2 : 1 between the periods advocated in the coupling theory of RR Lyrae stars might be reached in such models. A.

523.877

1031. ON THE APPLICATION OF THE RAYLEIGH–RITZ METHOD TO THE DETERMINATION OF THE FREQUENCY OF RADIAL OSCILLATIONS OF GASEOUS STARS WITH GREAT MASS CONCENTRATION. H.Elsen and P.Ledoux.
Bull. Soc. Roy. Sci. Liège, Vol. 24, No. 6-7-8-9, 239-53 (June-July-Aug.-Sept., 1955). In French.

It is shown by studying the radial oscillations of Epstein's model 4 that the Rayleigh–Ritz method yields successive approximations of the frequencies converging rapidly even in the case of such extreme central condensations. The same method applied to the radial oscillations of the model computed recently by Dumézil-Curien gives frequencies appreciably smaller than, say those of the standard model, due to the presence of a large external convection zone. Such models might then be useful in the interpretation of cepheids of type II and particularly of the RR Lyrae stars. Furthermore, they favour a commensurability 2 to 1 between the periods τ_0 and τ_1 of the fundamental and first modes. In fact, an interpolation tends to show that the value $\tau_1/\tau_0 \cong 0.5$ necessary for the coupling theory of RR Lyrae stars would be realized for $\tau_0 \sqrt{(\rho/\rho\Theta)} \cong 0.06$ which is very close to the observed value. A.

523.877

1032. VISCOSITY AND OSCILLATIONS OF GASEOUS STARS. J.Counson, P.Ledoux and R.Simon.
Bull. Soc. Roy. Sci. Liège, Vol. 25, No. 3, 144-62 (March, 1956). In French.

It is shown that despite an increase of the molecular

viscosity by a factor of the order of 200 with respect to previous values, when the preponderance of hydrogen is taken into account, its effects on the first few modes of radial and non-radial oscillations remain negligible, the damping times being still larger than the cosmic time-scale. In cases, where a large fraction of the star is in convective equilibrium, turbulent friction might have to be taken into account and it would reduce these damping times very much, bringing them down to some not too high multiples of the periods. A.

523.877 : 621.319.7 : 621.396.821

1033. STATIC IN THE STARS? C.E.R.Bruce.
Engineer, Vol. 202, 230-2 (Aug. 17, 1956).

Sets forth a series of observations which suggest that static is the origin of a diverse group of phenomena including the formation of electrical fields associated with terrestrial thunderstorms. The citations begin with the case of electrification of two like materials — such as cold dry-ice particles — when rubbed together asymmetrically. Such conditions may occur at about 30 000-40 000 ft where the anvil-shaped top of cirrus cloud appears and, after separation in a gravitational field, could cause electrification in thunderclouds. The effect is then discussed of "thunderstorms" in the atmospheres of variable stars, and the long lightning discharges associated therewith. Such discharges are shown to be equivalent to energy-pumps, and their resultant effect is described. The relationship of these discharges to certain phenomena occurring in combination-spectra stars is set forth. Their possible relevance to theories concerning the evolutionary processes in red giant stars, and the question of the uniformity of the chemical composition of matter throughout the universe, is discussed. A.A.Linsell

523.877 : 538.1

1034. ON FORCE-FREE MAGNETIC FIELDS. S.Chandrasekhar.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 1, 1-5 (Jan., 1956).

In the case of axial symmetry the magnetic intensity is expressed as the sum of toroidal and poloidal fields, and it is shown that explicit solutions may be obtained for fields satisfying the condition $\vec{H} \times \text{curl}\, \vec{H} = 0$ when the current is assumed proportional to H. The contributions to the magnetic energy from the toroidal and poloidal fields are shown to be equal. R.A.Newing

523.877

1035. SMALL MOTIONS IN A GASEOUS STELLAR MASS IN RADIATIVE EQUILIBRIUM. II. C.Agostinelli.
R.C. Accad. Naz. Lincei, Vol. 20, No. 3, 347-52 (March, 1956). In Italian.

For Pt I see Abstr. 5662/1956. The differential equation for the velocity field is set up for the case in which radiation pressure is not negligible, heat transport being by radiation. R.A.Newing

525.3

1036. PERTURBATIONS OF A SATELLITE'S ORBIT DUE TO THE EARTH'S OBLATENESS. L.Blitzer, M.Weisfeld and A.D. Wheelon.
J. appl. Phys., Vol. 27, No. 10, 1141-9 (Oct., 1956).

The free-flight motion of a satellite around a spherical earth is investigated neglecting atmospheric deceleration. This treatment is then extended by recognizing the earth's oblateness, which is represented by an additional quadrupole field. For nearly circular orbits, one finds that perturbations of the usual planar motion may be described analytically. These are characterized by a precession of the orbit plane around the equator, that is, a regression of the nodes, amounting to as much as forty miles per revolution. The large magnitude of these effects indicates that one may exploit a satellite's motion, as measured by conventional radio techniques, to determine the earth's oblateness to a new precision. A.

525.35

1037. NON-SEASONAL CHANGES IN THE EARTH'S ROTATION. H.Spencer Jones.
"Vistas in Astronomy", Volume II, 827-34. See Abstr. 10 (1957).

The fluctuations in the rotation of the earth can be interpreted as the combined effect of a slow secular increase, caused by tidal friction in shallow seas, and frequent small random changes. A unique separation between these two effects is not possible. Estimation of the secular increase is made uncertain by the cumulative effect of the random changes. The earth is subject also to an atmospheric accelerating couple, whose value is smaller than Jeffreys' estimate of the oceanic retarding couple. The uncertainty of the latter is such, however, that the couples may be equal, the rotation of the earth being held in synchronization with the atmospheric oscillation. The discordance between the observational ratio of the secular acceleration of the moon and sun and the theoretical value derived by Jeffreys is removed when the atmospheric accelerating couple is taken into consideration. A.Beer

529.786

1038. STARK MODULATION ATOMIC CLOCK. I.Takahashi, T.Ogawa, M.Yamano, A.Hirai and M.Takeyama.
Rev. sci. Instrum., Vol. 27, No. 9, 739-45 (Sept., 1956).

An atomic clock utilizing the Stark effect has been designed and constructed. In this clock, the error caused by the reflections in the microwave circuits has been successfully reduced to within the error by random noises, and the authors are sure of its possibility of long time operation. The accuracy has been estimated to be about 5×10^{-9} from observation of the received frequency of the standard station JJY, and comparison with the frequency of a quartz chronometer. The various components of this clock are described in detail, and the theoretical limits of the accuracy are also discussed. A.

PHYSICS 53

53.085.3

1039. THE DISPLAY OF MEASURED VALUES IN DIGITAL FORM. H.H.Emschermann.
Arch. tech. Messen, Issue No. 246, (Ref. J 071-5), 161-4 (July, 1956). In German.

Several forms of analogue-digital-converter are described. A converter for slowly varying voltages (1 measurement/sec) is based on an automatically-balanced, 3-decade, Thomson-Varley potentiometer. For rapidly varying voltages (1000 meas./sec), the measured voltage is compared in amplitude with a continuously-repeated, linear, saw-tooth voltage of constant slope and peak amplitude. The time interval between the start of the saw-tooth voltage and equality of the two voltages is measured by means of an oscillator and electronic counter. Four forms of digital display are illustrated. Also described is the following equipment of U.S. origin: a high-speed digital recorder (2400 numerals/sec), marking by spark-discharge on Teledeltos paper; a digital voltmeter, 10-1000 V, a.c. and d.c.; two digital-indicating spectrographic analysers for alloys; a frequency meter for high frequencies (using a electronic counter); apparatus (due to Pattison) for measurement of mechanical damping in materials. C.F.Pizzey

FUNDAMENTALS 530.1

530.12

1040. SOME REMARKS ON THE GENERAL RELATIVITY THEORY OF BIRKHOFF. P.Kustaanheimo.
Comment. phys.-math. [Helsinki], Vol. 17, Paper 11, 15 pp. (1955).

It is shown that the axiom system given by Barajas and Graef Fernandez for the relativity theory of Birkhoff is satisfied by a model with three arbitrary constants. One of these constants must be so chosen that the theory gives the Newtonian gravitation as a first approximation. One of the two other constants may be so chosen that one of the three crucial tests obtains an arbitrary value. If further the word "force" is interpreted in an unusual but natural way, one obtains a more general axiom system which admits models with six arbitrary constants. Two of the three new constants may be so chosen that also the second and third crucial tests obtain arbitrary values. A.

530.12 : 531.18

1041. EXPERIMENTAL VERIFICATION THAT THE VELOCITY OF LIGHT IS INDEPENDENT OF THE VELOCITY OF THE SOURCE RELATIVE TO THE OBSERVER. A.M.Bonch-Bruevich.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 481-4 (1956). In Russian.

Two wave-trains from opposite edges of the sun (one approaching, one receding from the earth) have their velocities compared by a phase modulation method. A quantity $\Delta\varphi$ is defined which should be proportional to the difference in the relative source velocities on a "ballistic" theory of light propagation, but should vanish if we accept the postulate (c = universal constant) of special relativity theory. Observed values of $\Delta\varphi$ were found to form a Gaussian distribution of mode zero and spread attributable to the experimental limitations.
J.W.Gardner

530.12

1042. APPLICATION OF AN ARTIFICIAL SATELLITE TO THE MEASUREMENT OF THE GENERAL RELATIVISTIC "RED SHIFT". S.F.Singer.
Phys. Rev., Vol. 104, No. 1, 11-14 (Oct. 1, 1956).

In view of the paucity of experimental tests for the general theory of relativity, it is desirable to consider the uses to which a satellite vehicle could be put. The advance of the perigee is calculated similarly to the perihelion advance of Mercury; it amounts to only 15 seconds of arc per year. However, the effect on a satellite clock is large and could be measured. With respect to an earth clock it is calculated to be a "red shift" for low-altitude orbits, zero shift for an orbit at one-half the earth's radius, and a "violet shift" for higher altitudes, where it approaches 7×10^{-10}. Some experimental schemes for the measurement of the clock shift are discussed; a counting technique seems to be best suited since it is capable of higher ultimate accuracy and avoids signalling problems during intercomparison arising from the motion of the satellite. A.

530.12 : 531.51

1043. NECESSITY OF SINGULARITIES IN THE SOLUTION OF THE FIELD EQUATIONS OF GENERAL RELATIVITY. A.Komar.
Phys. Rev., Vol. 104, No. 2, 544-6 (Oct. 15, 1956).

The Friedmann solution of the field equations of general relativity predict the expansion of the universe from a singular instant in time. This paper considers the behaviour of universes which are less symmetric than the Friedmann model, and which have more general fields that carry stress and energy and produce gravitation. The nonsymmetric problem is treated like the symmetric problem, via a "co-moving coordinate system" such that in it free infinitesimal test particles once at rest remain at rest. In such a coordinate system and with standard assumptions about the stress energy tensor it is found that the solutions of the field equations of the general theory of relativity necessarily have singularities at finite time. The considerations are independent of the symmetry, topology or boundary conditions assumed for the space-like three-dimensional hypersurfaces. A.

530.12 : 530.145

1044. ATTEMPTS AT QUANTIZATION OF THE GRAVITATIONAL FIELD. F.J.Belinfante.
Rev. Mexicana Fís., Vol. 4, No. 4, 181-91, 192-206 (Oct., 1955). In Spanish and English.

In a general review of recent theories, consideration is given to (i) linear theories possessing Lorentz covariance, (ii) theories involving approximations to Einstein's field equations, (iii) nonlinear theories possessing general covariance. R.A.Newing

530.12

1045. THE MEANING OF RELATIVITY. INVARIANCE AND COVARIANCE. H.Freistadt.
Rev. Mexicana Fís., Vol. 5, No. 1-2, 43-51 (Jan.-April, 1956). In Spanish.

Tensor covariance and invariance of dynamical laws, as axions of relativity, are not always equivalent. The implications of each axiomatic formulation, as well as arguments in favour of each, are reviewed. It is suggested that the question cannot be closed at the present time. A.

530.145

1046. MULTIPLE QUANTUM TRANSITIONS OF A SYSTEM OF COUPLED ANGULAR MOMENTA. M.N.Hack.
Phys. Rev., Vol. 104, No. 1, 84-8 (Oct. 1, 1956).

The transition probabilities of the multiple quantum transitions of a system of coupled angular momentum vectors in a uniform static plus perpendicular rotating magnetic field are studied both in the uncertainty width region, by time-dependent perturbation theory, and at higher amplitudes of the rotating field, by direct integration of the Schrödinger equation, in the case of well separated resonance frequencies. A.

530.145

1047. UNIQUENESS OF THE FINE-STRUCTURE CONSTANT. I.E.Segal.
Proc. Nat. Acad. Sci. U.S.A., Vol. 41, No. 12, 1103-7 (Dec., 1955).

Outlines a direct and rigorous approach to the dynamics of fields of elementary particles. It is deduced that under realistically general circumstances the coupling constant in a fully covariant interaction theory must be uniquely determined. The main novelty is in the formulation of dynamics exclusively in terms of group representations, without the use, in principle, of Lagrangians or partial differential equations. This clarifies the covariance of the theory and leads in particular to a simple, unique method of going from a theoretically given particle to a corresponding field. A.

530.145

1048. A POSSIBLE INTERPRETATION OF THE PERTURBATION THEORY SERIES IN THE QUANTUM THEORY OF FIELDS. V.I.Ogievetskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 5, 919-22 (1956). In Russian.

By way of example, a divergent series in e^2 corresponding to vacuum polarization in a constant magnetic field, is summed by the Borel B* method and found to give the correct answer. It is then conjectured that the perturbation series of the S-matrix, which is considered as a generalized function or distribution, might be summed in the same way, and that the original expansion for the purpose of renormalization, etc., might be legitimate. G.E.Brown

530.145

1049. ASYMPTOTIC EXPRESSION OF THE GREEN'S FUNCTION OF THE ELECTRON IN QUANTUM ELECTRODYNAMICS. L.D.Landau, A.A.Abrikosov and I.M.Khalatnikov.
Dokl. Akad. Nauk SSSR, Vol. 95, No. 4, 773-6 (1954). In Russian.

Following the methods developed previously (Abstr. 7966/1956), behaviour of the Green's function G and vertex part Γ_μ under gauge transformations is investigated. If the longitudinal part d_1 of the photon propagator is chosen to be zero, no divergences arise in Γ_μ and G. G.E.Brown

530.145

1050. THE ASYMPTOTIC GREEN'S FUNCTION IN QUANTUM ELECTRODYNAMICS. E.S.Fradkin.
Zh. éksper. teor. Fiz., Vol. 28, No. 6, 750-2 (1955). In Russian.

Using a generalization of Ward's identity, the asymptotic forms given by Landau et al. (see preceding abstract and Abstr. 7969/1956) can easily be derived. Several general characteristics of a renormalized theory are discussed. G.E.Brown

530.145

1051. SPECTRAL REPRESENTATION AND THE RENORMALIZATION GROUP. A.A.Logunov.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 740-2 (1956). In Russian.

If the Green's function is taken as a superposition of free-field Green's functions with different masses, then the spectral distribution function can be obtained from the Lie equations of the renormalization group and perturbation theory. G.E.Brown

530.145

1052. ON THE MATHEMATICAL STRUCTURE OF T.D. LEE'S MODEL OF A RENORMALIZABLE FIELD THEORY. G.Källén and W.Pauli.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 30, Paper 7, 23 pp. (1955).

It is shown that the appropriate mathematical formalism of the field theoretical model recently proposed (Abstr. 9936/1954) by T.D. Lee must use an indefinite metric to describe the norm of the state vector in the Hilbert space. The appearance of the indefinite metric is intimately connected with a new state of the V-particle having an energy that is below the mass of the "normal" V-particle. It is further shown that the S-matrix for this model is not unitary and that the probability for an incoming V-particle in the normal state and a boson, to make a transition to an outgoing V-particle in the new state and another boson, must be negative if the sum of all transition probabilities for the incoming state mentioned shall add up to one. A.

530.145

1053. THE INTERACTION STRENGTH AND RENORMALIZATION IN PHOTON PAIR THEORY. C.P.Enz.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 363-418 (1956). In German.

A detailed discussion of the theory of an electromagnetic field in interaction with a definite number of non-relativistic particles of finite extent. The renormalization of the theory is considered and it is shown that unphysical states may appear. P.T.Matthews

530.145

1054. CHARGE RENORMALIZATION FOR ARBITRARY VALUES OF e_0 WHICH ARE NOT SMALL. K.A.Ter-Martirosyan.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 157-9 (1956). In Russian.

Taylor's work (Abstr. 3478/1956) is criticized in that one of his assumptions about continuity of a function appears unreasonable. It is then shown that if e_0, the unrenormalized charge, is taken as a fixed quantity and the renormalized charge e_C is considered as $e_C^2(e_0^2,L)$, where L is related to the momentum cut-off, then $e_C^2 \to 0$ as $L \to \infty$ for any values of e_0^2, not only for $e_0^2 \ll 1$. G.E.Brown

530.145

1055. DISPERSION RELATIONS FOR FERMI PARTICLES. V.Faĭnberg and E.Fradkin.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 507-10 (1956). In Russian.

Dispersion relations for nucleon–nucleon scattering are derived in a way similar to that used by Goldberger (Abstr. 8486/1955) for bosons. The real parts of the forward amplitudes are expressed as integrals over the cross-sections for nucleon–nucleon and nucleon–antinucleon scattering and the analytic continuations of cross-sections for meson production in nucleon–antinucleon annihilations. G.E.Brown

530.145

1056. RELATIVISTIC QUANTUM MECHANICS AND MASS-QUANTIZATION. H.Enatsu.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 526-86 (1956).

Emphasizes how the usual quantum-mechanical Hamiltonian formalism can include self-interactions which are closely related to the quantized masses of elementary particles. A detailed programme of mass-quantization is carried through for the case of a pseudo-scalar meson interacting with nucleons through the usual couplings. Earlier work (Abstr. 8928/1954 3433/1955) on mass-quantization for the case of a Dirac particle interacting with a scalar photon pointed up certain ambiguities (associated e.g. with the introduction of "internal" coordinates and with the relativistic definition of the centre of mass) which are resolved in the present discussion. Eigenvalues of masses obtained are in reasonable agreement with those observed for π- and heavy mesons. J.W.Gardner

530.145

1057. SCATTERING BY A SQUARE WELL POTENTIAL. D.Geissler.
Ann. Phys. (Leipzig), Vol. 18, No. 3-4, 113-24 (1956). In German.

The S-, P- and D-phase-shifts for the scattering of particles of equal mass, interacting through a square-well potential, are calculated for the non-relativistic, and the relativistic, Schrödinger equation and are exhibited graphically. In these graphs a combination of the potential depth and range is plotted against a function of the radius and energy of the incoming particle, for fixed values of the phase shifts. Possible uses of these curves are discussed. P.T.Matthews

530.145 : 539.18

1058. ON A COMPOSITE MODEL FOR THE NEW PARTICLES. S.Sakata.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 6, 353-4 (1956).

All hyperons are assumed to be made up of four basic particles: nucleons, antinucleons, Λ^0 and anti-Λ^0. Identification of the composite particles with π, θ, etc. is carried out. G.E.Brown

530.145

1059. RENORMALIZATION OF THE MESON CHARGE IN PSEUDOSCALAR THEORY WITH PSEUDOSCALAR COUPLING. I.Pomeranchuk.
Dokl. Akad. Nauk SSSR, Vol. 104, No. 1, 51-3 (1955). In Russian.

The two-limit procedure is applied to the meson equations assuming that g_1^2 is small, where g_1 is the unrenormalized charge. It is shown that the renormalized charge tends to zero as the momentum cut-off goes to infinity. G.E.Brown

530.145

1060. ON THE TENDING TO ZERO OF THE RENORMALIZED MESON CHARGE IN PSEUDOSCALAR THEORY WITH PSEUDOSCALAR COUPLING. I.Pomeranchuk.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 3, 461-4 (1955). In Russian.

The treatment for small g_1^2 (see preceding abstract) is extended to arbitrary values of g_1^2. This necessitates calculation of higher order, crossed vertex graphs and graphs corresponding to the scattering of mesons by mesons. These do not seem to change the previous results. G.E.Brown

530.145

1061. SOLUTION OF THE EQUATIONS OF PSEUDOSCALAR MESON THEORY WITH PSEUDOSCALAR COUPLING. I.Ya.Pomeranchuk.
Zh. éksper. teor. Fiz., Vol. 29, No. 6 (12), 869-71 (1955). In Russian.

In two recent articles by the same author (see two preceding abstracts) the role of scattering of mesons by mesons in vertex parts was only partially considered, but it is found that this does not change the conclusion that the unrenormalized coupling constant g goes to zero. G.E.Brown

530.145

1062. PROBLEM OF RENORMALIZATION IN MESODYNAMICS. A.M.Brodskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 939-42 (1956). In Russian.

Using the Schwinger proper-time technique and varying with respect to an external gravitational field, the calculation of Schwinger of the vacuum polarization contribution to the action function can be extended to the meson field. Renormalization is carried out. G.E.Brown

530.145

1063. EFFECTIVE POTENTIAL OF THE π-MESON–NUCLEON INTERACTION. V.R.Velibekov and V.A.Meshcheryakov.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 951-4 (1955). In Russian.

A separable potential is taken as an approximation to the meson–nucleon potential found in the static theory. Remaining parameters are determined by requiring the resulting theory to agree with perturbation theory for low energies. G.E.Brown

530.145

1064. THEORY OF SCATTERING OF DIRAC PARTICLES WITH INCLUSION OF DAMPING. A.A.Sokolov and B.K.Kerimov.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 961-4 (1955). In Russian.

The formalism is developed for the scattering of a particle by a strong centre. Calculations are carried out after specializing to a δ-function potential. G.E.Brown

530.145

1065. TWO-CHARGE RENORMALIZATION GROUP IN PSEUDOSCALAR MESON THEORY. D.V.Shirkov.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 972-5 (1955). In Russian.

The procedure developed earlier for quantum electrodynamics is applied here to pseudoscalar meson theory with coupling to a nucleon field. The coefficient of the φ^4 term, which must be added for renormalization, plays the role of a second charge. G.E.Brown

530.145

1066. SCATTERING THEOREMS FOR BOUNDED PERIODIC STRUCTURES. V.Twersky.
J. appl. Phys., Vol. 27, No. 10, 1118-22 (Oct., 1956).

Theorems relating the plane wave modes (scalar or vector) transmitted and reflected by periodic structures of lossless elements bounded by two parallel planes are derived. One special case is continuity of energy flux normal to the boundary planes, and others relate the phases, or both phases and magnitudes, of the propagating modes. These relations are essentially discrete analogues (i.e., with integrals over all angles of observation replaced by sums over propagating mode directions) of the relations for a bounded scatterer given by Saxon. The essential difference in the two situations is that by restricting the parameters so that only a few modes propagate special cases are obtained which can be treated relatively explicitly. Thus the case of one propagating mode, and the cases corresponding to Bragg reflections are discussed in some detail; here there is both conservation of magnitude and phase. A.

530.145

1067. ELECTROMAGNETIC PROPERTIES OF THE DEUTERON. EXCHANGE CURRENT CONTRIBUTIONS TO ELECTRON–DEUTERON SCATTERING AT HIGH ENERGIES. J.Bernstein.
Phys. Rev., Vol. 104, No. 1, 249-53 (Oct. 1, 1956).

The analysis of high-energy electron–deuteron scattering depends on a knowledge of the two-nucleon charge density. This is proportional to the square of the two-body amplitude if meson exchanges are neglected. If these are included one may derive an effective charge density operator as an expansion in the number of mesons exchanged. This work shows that the one-meson part of this operator can give a contribution of several per cent to the differential cross-section for electron–deuteron scattering at large angles and high energies. A.

530.145

1068. INSENSITIVITY OF THE SCATTERING MATRIX. H.Ekstein and K.Tanaka.
Phys. Rev., Vol. 104, No. 1, 259-63 (Oct. 1, 1956).

It is conjectured that the S-matrix, expressed in terms of rigorous one-particle states, is insensitive to a substitution for the rigorous one-particle states of any approximate state which, by adiabatic switching on of the interaction, is carried into a rigorous one-particle state. This conjecture, first suggested by the fact that the usual form of the S-matrix contains bare-particle states, is supported by the proof that the S-matrix element between one bare and one "real" particle (e.g., bare meson and real nucleon, bare nucleon and real meson, one bare and one real nucleon) is exactly correct. The equivalence of our S-matrix element with Low's form of the S-matrix element for nucleon–meson scattering is one of the above cases. It is pointed out that great simplifications in calculations could be secured if the conjecture were verified. A.

530.145

1069. SOME RELATIONS BETWEEN THE BOUND STATE PROBLEM AND SCATTERING THEORY. N.Fukuda.
Progr. theor. Phys., Vol. 15, No. 4, 414-15 (April, 1956).

In non-relativistic wave mechanics it is shown that the energy shift due to a central potential at the centre of a large sphere is proportional to the appropriate scattering phase shift. An expression is given for the nucleon self-energy, in the no-recoil PS(PV) meson theory, involving an integral over meson–nucleon phase shifts at all energies. J.S.Bell

530.145

1070. ASYMPTOTIC GREEN'S FUNCTION OF THE NUCLEON AND MESON IN PSEUDOSCALAR THEORY WITH WEAK INTERACTION. A.D.Galanin, B.L.Ioffe and I.Ya.Pomeranchuk.
Zh. éksper. teor. Fiz., Vol. 29, No. 1 (7), 51-63 (1955). In Russian.

The coupled integral-differential equations on the vertex part and Green's functions, which were renormalized by the authors previously (Dokl. Akad. Nauk SSSR, Vol. 98, No. 3, 361-4, 1954), are solved in the asymptotic range without perturbation theory. All infinities are seen to have been separated. The selection of graphs which are summed is such that the analysis is valid only for $\ln(-p^2/m^2) < 4\pi/5g^2$. At the point where these two quantities are equal a false pole occurs, which, it is surmised, might be removed by inclusion of neglected graphs. It is in the sense of the above condition that the theory is one of weak interaction. G.E.Brown

530.145

1071. CONCERNING THE APPLICATION OF NON-SELF-CONJUGATE OPERATORS IN SCATTERING THEORY. M.S.Livshits.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 121-31 (1956). In Russian.

It is shown that in the simplest triangular representation one can determine a non-selfconjugate compound nucleus energy operator from a given scattering matrix. The dependence of compound nucleus disintegration on the character of the nuclear spectrum is investigated. A.

530.145

1072. REMARKS ON THE THEORY OF THE SCATTERING OF PARTICLES WITH A GIVEN TOTAL ANGULAR MOMENTUM. V.T.Khozyainov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 138-40 (1956). In Russian.

The interaction operator corresponding to two fermions interacting through a boson field is expanded in angular momentum eigenvalues. Renormalization is indicated in this representation for the polarization of the vacuum. G.E.Brown

530.145

1073. DYNAMIC MAGNETIC MOMENT OF THE DEUTERON. A.M.Korolev.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 211-17 (1956). In Russian.

The dynamic magnetic moment of the deuteron is investigated in the fifth approximation of perturbation theory on basis of pseudoscalar meson theory with a pseudoscalar coupling. Exchange currents in the deuteron significantly contribute to the dynamic magnetic moment. A.

530.145

1074. A QUASI-UNIDIMENSIONAL INTERPRETATION OF THE HYDRODYNAMICAL THEORY OF MULTIPLE PARTICLE PRODUCTION. I.L.Rozental'.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 278-87 (1956). In Russian.

The hydrodynamical theory of multiple formation of particles developed by Landau is based on the introduction of two stages of separation of the liquid: a unidimensional motion and a conical separation whose limits of validity are difficult to estimate. The hydrodynamical theory version in which only the unidimensional stage is involved is investigated in the present paper. It is shown that this variant yields a very satisfactory approximation for the values of the final temperatures $T_k \sim 1.5\text{-}2\ \mu$. For $T_k = \mu$ the unidimensional approximation yields (especially for slow secondary particles) a result which is correct only in order of magnitude. The dependence of the energy of the fastest particle on $T_k = \mu$ was also investigated. It is found that in order for the calculated value of the velocity to agree with the experiment value the condition $T_k \sim< \mu$ must be satisfied. A preliminary conclusion can be drawn that the interaction cross-section of the secondary particles (apparently π-mesons) for $T_k \sim \mu$ is of the order of the geometrical value. A.

530.145

1075. POINCARÉ'S THEOREM FOR AN ENSEMBLE OF OSCILLATORS. R.Balescu.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 42, No. 5, 622-7 (1956). In French.

Conditions are established under which a system of slightly anharmonic oscillators does not admit of uniform and analytic integrals of the motion. The results are applied to a discussion of Peierls' system of oscillators on a lattice. A.

530.145

1076. DECOMPOSITION IN CLEBSCH PARAMETERS OF THE DIRAC MOMENTUM AND THE PHYSICAL INTERPRETATION OF THE GAUGE INVARIANCE OF THE EQUATIONS OF WAVE MECHANICS. G.Jakobi and G.Lochak.
C.R.Acad. Sci. (Paris), Vol. 243, No. 4, 357-60 (July 23, 1956). In French.

It is shown that, in the hydrodynamical interpretation of the Dirac equation, the introduction of relativistic Euler angles leads to the Clebsch decomposition of the momentum. Gauge invariance is interpreted as the impossibility of defining an absolute proper rotation in the spinning fluid. J.S.Bell

530.145

1077. THE EQUIVALENCE OF VARIATIONAL AND PERTURBATION CALCULATIONS OF SMALL DISTURBANCES. A.Dalgarno and J.T.Lewis.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 628-30 (Aug., 1956).

530.145

1078. REDUCTION OF WAVE EQUATIONS FOR SPIN 0 OR 1 TO THE HAMILTONIAN FORM. F.I.Fedorov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 140-2 (1956). In Russian.

The wave equation $(\beta_k \nabla_k + \chi)\Psi = 0$ is reduced to Hamiltonian form by using the commutation relations of the β's, without employing a special representation at any point. This reduction is carried out simultaneously for spin 0 and spin 1 particles. G.E.Brown

530.16

1079. POINCARÉ RECURRENCES. H.L.Frisch.
Phys. Rev., Vol. 104, No. 1, 1-5 (Oct. 1, 1956).

In connection with the tracing of the origin of the apparent irreversibility exhibited by a class of simple mechanical systems, namely all multiply or conditionally periodic Hamilton–Jacobi systems, estimates are obtained for the Poincaré recurrence time of such a system in terms of the preassigned limits of error of the

mechanical recurrence, ϵ. By applying the theory of diophantine approximations, the asymptotic fraction of the time a system spends in such recurrences is found exactly. These results allow further deductions concerning the fraction of time a given system obeys a strict version of the second law of thermodynamics, as well as the existence and order of magnitude of the average Poincaré recurrence time of a Gibbsian ensemble of such system whose degrees of freedom are indistinguishable. The relation of the results obtained for this important class of mechanical systems and the resolution of the paradoxes of heat theory propounded by Zermelo, Loschmidt, etc., due to Boltzmann and von Smoluchowski, is discussed. An especially easily visualized model, the one-dimensional gas of hard spheres, is treated, in particular, in some detail. A.

530.162 : 536.7 : 519.2

1080. SOME REMARKS ON THE USE OF PROBABILITY IN CLASSICAL STATISTICAL MECHANICS. M.Kac.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 42, No. 3, 356-61 (1956).

A simple artificial model is constructed for the purpose of explaining the role of probabilistic notions in establishing "irreversibility" on reversible systems. A.

530.162

1081. A GAUGE-INVARIANT ANALOGUE OF THE WIGNER DISTRIBUTION. R.L.Stratonovich.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 1, 72-5 (1956). In Russian.

An invariant distribution w(P, q), which can be used to define averages, is found and the equations that it satisfies are derived for the quantum and classical cases. G.E.Brown

530.162 : 536.7

1082. AN OUTLINE OF A PURELY PHENOMENOLOGICAL THEORY OF STATISTICAL THERMODYNAMICS. I.CANONICAL ENSEMBLES. B.Mandelbrot.
I.R.E. Trans Inform.Theory, Vol. IT-2, No. 3, 190-203 (Sept., 1956).

The aim is to show (partly after Szilard) that a substatial part of the results usually obtained through kinetic arguments could be obtained by postulating from the outset a statistical distribution for the properties of a system, and following up with a purely phenomenological argument. The spirit of the theory is extremely close to that of the conventional (Copenhagen) approach to quantum theory, and the results are quite parallel, although the mathematics is quite different. Randomness is introduced by following the modern statistical theory of the estimation of non directly observable intensive variables of state, such as the temperature. The discussion of the methodological foundations of modern statistics can thus be translated into a full-fledged, and possibly significant, counterpart of the discussion of the kinetic foundations of thermodynamics. Statistics is thus provided with a particularly concrete example for some of its more involved methods; thermodynamics appears clarified in its classical aspects, and is further completed with an apparently new uncertainty relationship. A.

530.162

1083. CONTINUITY, DETERMINISM, AND REALITY. M.Born.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 30, Paper 2, 26 pp. (1955).

530.162 : 533.73

1084. ENERGY OF A MANY-PARTICLE SYSTEM. W.B.Riesenfeld and K.M.Watson.
Phys. Rev., Vol. 104, No. 2, 492-510 (Oct. 15, 1956).

A formulation of the energy eigenvalue problem for a many-particle system is presented in several alternative forms and, following Brueckner and his collaborators, the energy of the system is expressed in terms of solutions to the two-body problem. This work bears considerable resemblance to Brueckner's "linked cluster" expansion. The present expansion is derived with the aid of an ordering operator and involves a sequence of "nearest neighbour" interactions. The particles tend to form "chains", the sequence of approximations involving "two-particle chains", "three-particle chains", etc. The rapidity of convergence of the method depends on the particle density and "temperature" and on the nature of the force between particles. The method lends itself readily to use in statistical mechanics. Some applications to the calculation of the equation of state of a gas are included. A.

530.162

1085. THEORY OF CLASSICAL SYSTEMS OF INTERACTING PARTICLES OBEYING A NON-CENTRAL INTERACTION LAW. I. A.E.Glauberman.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 218-23 (1956). In Russian.

The theory of systems of particles interacting according to a non-central law is considered on basis of the Bogolyubov method. Successive approximations for the distribution functions have been obtained in the two simplest cases, that is for a gas consisting of non-symmetrical diatomic neutral molecules and for a dipolar crystal. A.

530.162

1086. REPLACEMENT OF A NON-STATIONARY RANDOM PROCESS BY A STATIONARY ONE. V.I.Tikhonov.
Zh. tekh. Fiz., Vol. 26, No. 9, 2057-9 (1956). In Russian.

Mathematical expressions for both types of process are taken and correlation functions worked out for them, in one case using statistical means and in the second taking the mean over the period $T = 2\pi/\omega$. The conditions in which it is possible to employ this latter operation and the physical meaning of the results are discussed. Taking an expression in which the stationary random process part is independent of the rest the author considers its application to the case of a valve oscillator. C.R.S.Manders

530.19

1087. RADIATIVE TRANSFER WITH DISTRIBUTED SOURCES. R.G.Giovanelli and J.T.Jefferies.
Proc. Phys. Soc. B, Vol. 69, Pt 11, 1077-84 (Nov., 1956).

The Eddington approximation is applied to obtain expression for the total intensity of the diffuse radiation in composite diffusers containing or illuminated by non-uniformly distributed sources. Methods are given for simplifying the solutions for point and line sources in highly scattering media. A.

GENERAL MECHANICS. MECHANICS OF SOLIDS 531

531

1088. CLASSICAL MECHANICS. I. GEOMETRICAL DESCRIPTION. M.Pihl.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 30, Paper 12, 22 pp. (1955). In Danish.

The possibilities of giving a geometrical description are discussed, starting from a short historical review. A geometrization of this kind requires the general so-called Finsler-geometry, a short account of whose main features, adapted to the purpose, is given. It is then shown that the introduction of an extra coordinate, a so-called cyclic coordinate, allows a reduction to the more specialized Riemann geometry. It is here a question of a slight change in an idea, originally formulated by J.J.Thomson, which in particular forms the basis of H.Hertz' endeavours to eliminate the concept of force in mechanics. It is finally shown that this geometrization also can be applied to time-dependent, holonomic dynamical systems, leading to a geometrical description which already has been studied by L.P.Eisenhart. A.

531.234

1089. THE RADIAL DEFORMATION OF AN ANISOTROPIC HOLLOW SPHERE POSSESSING ELASTIC REMANENCE. M.I.Rozovskii.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 920-3 (1955). In Russian.

A hollow sphere of a material with curvilinear anisotropy and elastic remanence is subjected to hydrostatic pressure. A very complicated expression for the resulting displacements is derived. This type of problem was first examined by Volterra (Acta Mathematica, Vol. 35, 295, 1912). A.L.Mackay

531.52 : 531.55 : 538.3

1090. TECHNICAL ASPECTS OF LEVITATION. A.H.Boerdijk.
Philips Res. Rep., Vol. 11, No. 1, 45-56 (Feb., 1956).

Levitation of a body is here defined as a state of either stable or indifferent equilibrium relative to the earth in which material contact between the body and its environment is not essential. The possibilities and limitations of levitation by auxiliary gravitational forces, by reaction forces and by forces in electromagnetic fields

are investigated. Levitation by gravitational forces or by radiation pressure is not feasible in practice, whilst levitation by forces in electrostatic fields is theoretically impossible. Under certain conditions levitation may be achieved by reaction forces and by forces in magnetostatic, stationary and quasi-stationary electromagnetic fields. Published applications comprise balances, centrifuges, and a method for melting metals in vacuo without a crucible. A.

MECHANICAL MEASUREMENTS 531.7

531.71

1091. FINE MEASUREMENTS. J.R.Adams.
J. sci. Instrum., Vol. 33, No. 10, 369-75 (Oct., 1956).

The limitations of the existing legal standards of linear measure are considered. The use of light waves as a universal reference of linear measure depends on the availability of a source of truly monochromatic light and considerable progress has been made using the isotope Hg^{198}. Many aspects of engineering require measurements accurate to a few micro-inches and instruments capable of meeting such demands have been designed. Several typical instruments, together with details of the principles on which they are based, are briefly reviewed. A.

531.714

1092. EFFECT OF STRAIN RATE ON THE BEHAVIOR OF ISO-ELASTIC WIRE STRAIN GAUGES. A.H.Meitzler.
Rev. sci. Instrum., Vol. 27, No. 1, 56 (Jan., 1956).

531.714

1093. DUAL OBJECTIVE OPTICAL MICROMETER FOR STRAIN MEASUREMENTS. R.Papirno, A.C.Gilbert and H.Becker.
Rev. sci. Instrum., Vol. 27, No. 10, 854-5 (Oct., 1956).

A micrometer for strain measurements of up to 8% is described. In this instrument the images of two reference marks on a specimen are brought to a focus in one field on the reticle scale of a filar micrometer eyepiece. The relative displacement of the images is measured by the eyepiece and the readings are reduced to strain by the use of a calibrated magnification factor. Since only the separation distance of the images is of interest, the exact position of the images in the field is not critical. No external point of reference on the instrument mount is necessary, hence alignment problems are minimized and the instrument may be moved between readings. The described calibration procedure shows that the least count of the instrument with a 2.64 in. gauge length is 42×10^{-6} in./in. and measurements can be made with an accuracy of $\pm 13 \times 10^{-6}$ in./in. A.

531.752

1094. A QUARTZ FIBRE ULTRA MICROBALANCE FOR USE INSIDE AN EVACUATED CONTAINER. W.P.Hutchinson.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1757, 4 pp. (1955).

A fused quartz fibre ultramicrobalance is described, using weights in conjunction with a torsion fibre, with a sensitivity of about 10^{-8} g/division. It may be used in a vacuum for weighing quantities from a few microgrammes to 200 milligrammes. A.

531.76 : 621.317.39

1095. HIGH-RESOLUTION MILLIMICROSECOND TIME INTERVAL MEASUREMENTS BASED UPON FREQUENCY CONVERSION. C.Cottini, E.Gatti and G.Giannelli.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 156-7 (July, 1956).

Each of the two pulses whose interval is to be measured excites a separate high-Q tuned circuit whose frequency differs by about say 1% at 30 Mc/s. The two damped oscillations pass through a ring demodulator which produces a low-frequency oscillation the phase of which is determined by the interval between the pulses. A time difference of 5×10^{-9} sec appears as a phase-shift of 5×10^{-7} sec in the position of the first zero of the l.f. oscillation. D.R.Chick (R)

531.787.3

1096. PISTON MANOMETER WITH DIRECT INDICATION. J.Gielessen and K.Hild.
Z. angew. Phys., Vol. 8, No. 9, 450-2 (Sept., 1956). In German.

The pressure (fluid) acts on a slowly rotating piston of known dimensions, and the force developed is applied via two levers acting in series, onto the pendulum-weight type measuring device with indicator. A range of pressures can be covered by adding weights to one of the levers, and by changing the diameter of the piston and its cylinder. The levers reduce the force applied to the measuring device by a factor of 30, with corresponding reduction in piston movement. Calibration against a standard pressure balance gives agreement better than .01% of maximum (285 atm). F.Ansbacher

531.787.6

1097. A DIRECT-READING DOUBLE-SIDED MICROMANOMETER. J.J.Opstelten, N.Warmoltz and J.J.Zaalberg van Zelst.
Appl. sci. Res. B, Vol. 6, No. 1-2, 129-36 (1956).

On each side of a thin diaphragm, separating two chambers, a condenser plate is mounted at a small distance. The two capacities thus formed are part of a bridge circuit which is fed by a high frequency oscillator. An amplifier with a narrow band width and a phase-dependent rectifier give a voltage which is fed back to the manometer. At one side of the diaphragm a pressure prevails, much lower than the one to be measured, at the other side the gas is admitted, the pressure of which is to be measured. The displacement of the membrane by the gas pressure is almost completely compensated electrostatically by the feedback voltage. By virtue of a differential method of feedback the reading is proportional to the pressure. The range is from 10^{-5}-0.5 mm of mercury pressure difference at any absolute value. The apparatus is made of chemically fairly resistant materials, and as its indication is in principle independent of the nature of the gas, it can be used for almost every gas. The apparatus can also be used as a non-direct reading instrument in which case the upper limit of the range is 1 mm of mercury. A.

MECHANICS OF FLUIDS 532

532.13 : 536.48

1098. TEMPERATURE DEPENDENCE OF VISCOSITY OF LIQUEFIED NITROGEN AT CONSTANT DENSITY. N.F.Zhdanova.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 14-17 (1956). In Russian.

Results of measurement of the temperature dependence of the viscosity of liquified nitrogen are presented; the measurements were carried out in the density range from $\rho = 0.38$ g/cm^3 to $\rho = 0.86$ g/cm^3 and for temperatures varying from the condensation temperature up to 300° K. A gas-like temperature dependence of the viscosity of liquid nitrogen at low densities has been detected for the first time. A.

532.137

1099. MOVEMENT OF A NEWTONIAN LIQUID BETWEEN ROTATING COAXIAL CYLINDERS IN PRESENCE OF INTERNAL THERMAL PROCESSES AFFECTING VISCOSITY. T.Ya.Gorazdovskiĭ and S.A.Regirer.
Zh. tekh. Fiz., Vol. 26, No. 7, 1532-41 (1956). In Russian.

Familiar viscometric formulae are corrected for the effect of frictional heating on the coefficient of viscosity. By the way of an example it is shown that this correction amounts to 5% of the viscosity of castor oil if the radii of the cylinders are 2.5 and 2 cm and the angular velocity of the inner cylinder increases from 1.2 to 11.35 sec^{-1} and the outer cylinder stays at rest. R.Eisenschitz

532.5

1100. VARIATIONAL PRINCIPLES IN HYDRODYNAMICS. V.I.Skobelkin.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 317-23 (1956). In Russian.

New variational principles which are characterized by special variation in the presence of auxiliary conditions are formulated in the present paper; this permits one to solve hydrodynamical and gas-dynamical problems by straightforward methods. A.

532.5.032 : 536.75 : 536.22

1101. THE MOTION OF A VISCOUS FLUID CONDUCTING HEAT. J.L.Synge.
Quart. appl. Math., Vol. 13, No. 3, 271-8 (Oct., 1955).

The motion of a viscous fluid conducting heat is discussed mathematically, using specific entropy and specific volume as

basic thermodynamic variables; only one coefficient of viscosity is considered. Small disturbances from equilibrium are discussed and exponential solutions of the equations, linearized for the case of small disturbances, are derived. The author considers that mechanics and thermodynamics have hitherto been unnecessarily kept apart, and that thermohydrodynamics takes on a clear mathematical form only when entropy is given a leading role. J.S.G.Thomas

532.517 : 532.66

1102. SLIPPAGE OF WATER OVER NONWETTABLE SURFACES. E.Schnell.
J. appl. Phys., Vol. 27, No. 10, 1149-52 (Oct., 1956).

When water flows over glass which has been treated with the vapour of dimethyldichlorosilane and thus made water-repellent, slipping on the boundary between the solid surface and the water takes place. This is shown in capillary tubes of various diameters. The amount of slipping is small, but measurable. It disappears or becomes extremely small in case of turbulent flow. A.

532.517

1103. THE FLOW OF A LIQUID OF ANOMALOUS VISCOSITY BETWEEN TWO FLAT PLATES AND BETWEEN TWO CO-AXIAL CYLINDERS. N.V.Tyabin.
Zh. tekh. Fiz., Vol. 26, No. 9, 1994-2001 (1956). In Russian.

The rheological behaviour of a non-Newtonian liquid is assumed to be determined by an equation between the tensors of stress and of the rate of strain. It is further assumed that this relation can be represented graphically in such a way that linear segments are joined continuously but with a kink. From these assumptions the velocity distribution and other quantities of interest are derived by standard procedures. R.Eisenschitz

532.517.2 : 541.128

ON CHEMICAL SURFACE REACTIONS IN LAMINAR BOUNDARY LAYER FLOWS. See Abstr. 1706

532.59

1104. PART PLAYED BY THE TANGENTIAL FORCE OF THE WIND IN THE INCREMENT OF THE ENERGY OF WAVES. V.V.Shuleĭkin.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 761-3 (1956). In Russian.

Develops the following equation for the power transmitted to water waves by the tangential (frictional) force of the wind $W_f = 2\pi\epsilon k\delta_\alpha(r_0/T)(V_0 - c)^2$, where ϵ = the dimensionless aerodynamical coefficient, k = the coefficient of friction, δ_α = density of air, r_0 = half-height of waves, T = period of waves, V_0 = wind velocity, and c = phase velocity of waves. When combining this equation with that developed in a previous paper (Izv. Akad. Nauk SSSR, Ser. geofiz., No. 5, 1954) for the power transmitted by the normal forces $W_\nu = Ar_0(V_0 - c)^2$, one obtains the ratio $W_\nu/W_f = AT/2\pi\epsilon k\delta_\alpha$. For $T \cong 3$ sec, one obtains $W_\nu/W_f = 45$. F.Lachman

CAPILLARITY 532.6

532.613.5

1105. ON THE STABILITY OF THE SPHERICAL SHAPE OF A VAPOR CAVITY IN A LIQUID. M.S.Plesset and T.P.Mitchell.
Quart. appl. Math., Vol. 13, No. 4, 419-30 (Jan., 1956).

The stability of the spherical interface between two immiscible incompressible non-viscous fluids of different densities, in accelerated motion, is discussed mathematically. For small amplitude perturbations of the spherical surface, the stability criterion deduced by Taylor for the plane case (Abstr. 3808/1950) is shown to be subject to important modifications. For an expanding vapour cavity, an initially spherical shape is stable provided the initial deformation amplitude is small compared with the initial cavity radius. When surface tension is unimportant, needle-like irregularities in the spherical surface may acquire significant amplitudes, but instability disappears when surface tension is significant. For a collapsing vapour cavity, the distortion amplitudes remain small so long as $1 \geq R/R_0 > \sim 0.2$, where R = the radius of the cavity, and R_0 = its initial radius. As $R \to 0$, the distortion amplitudes oscillate in sign with increasing frequency and increase in magnitude similarly to $R^{-1/4}$, both with and without surface tension. J.S.G.Thomas

532.613.5

1106. STABILITY OF SPHERICAL BUBBLES. G.Birkhoff.
Quart. appl. Math., Vol. 13, No. 4, 451-3 (Jan., 1956).

A general criterion for the stability of spherical bubbles is derived mathematically from the perturbation equations of spherical bubbles. The author considers Plesset's equation for stability (Abstr. 2071/1954) to be unjustified. J.S.G.Thomas

532.62

1107. A CERTAIN STABLE SHAPE OF THE FREE SURFACE OF A THIN LAYER OF HEATED LIQUID. R.Z.Alimov.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 559-60 (1956). In Russian.

Water droplets of 50-150 μ diameter are collected on the outer surface of a horizontal cylindrical tube; they form a film of 20-200 μ thickness flowing at a rate of 12-1200 kg/m² hour over the surface, being finally discharged in the form of large drops. The film is smooth and stable, even if the tube is heated from inside up to 80°C. At higher temperatures ripples are formed. Reasons are given to show that water is circulating within a ripple between the crest and the depression. If the temperature is raised to a higher level the film breaks up into rings separated by dry sections of the tube; in the neighbourhood of the boiling point the film evaporates completely. R.Eisenschitz

532.62 : 541.126

1108. DAMPING OF UNDERWATER EXPLOSION BUBBLE OSCILLATIONS. J.B.Keller and I.I.Kolodner.
J. appl. Phys., Vol. 27, No. 10, 1152-61 (Oct., 1956).

When an explosive detonates underwater it creates a bubble of gas which performs damped radial oscillations of large amplitude. The usual theory of these oscillations treats the water as incompressible and yields undamped oscillations of constant period. This theory has been modified by taking account of the compressibility of the water. This theory predicts damped oscillations of diminishing period. Comparison of the predicted and observed radius–time curves for one particular case shows fairly good agreement. Radius–time curves for four representative cases have been computed with a large number of periods in each case. These can be used to describe a variety of explosions. A.

532.62

1109. UNDAMPED FREE PULSATIONS OF AN IDEAL BUBBLE. R.B.Robinson and R.H.Buchanan.
Proc. Phys. Soc. B, Vol. 69, Pt 9, 893-900 (Sept., 1956).

For large bubbles (for example of diameter much greater than 3×10^{-4} cm for air bubbles in water at atmospheric pressure) the effects of surface tension on the motion may be ignored. It is then possible to put the equation of motion on a dimensionless basis. Solutions of this generalized equation have been obtained. Quantitative results are presented graphically and show, for example, the increase in period which occurs with increase in pulsation amplitude. The effects of variation of the compression exponent are also brought out. These dimensionless results are quite general in regard to external pressure, liquid density and bubble size. For comparison, a sample solution is given for a small bubble with allowance for surface tension. Discussion covers both the correlation of the results with available experimental evidence, and also various implications of the results, for example, in regard to forced pulsation. A.

532.65

1110. FREE FALL BREAKUP OF LARGE DROPS. R.H.Magarvey and B.W.Taylor.
J. appl. Phys., Vol. 27, No. 10, 1129-35 (Oct., 1956).

The breakup of large water drops during free fall is of importance to meteorologists. Theories of precipitation lean heavily on drop multiplication resulting from the shattering of large drops. An experiment is described in which the actual breakup of large drops is observed, and data obtained from which the mechanism of break may be inferred. Drops in the various stages of disintegration have been photographed and the size distribution of fragments noted. A large drop falling freely through the air deforms, inflates somewhat in the same manner as a parachute and bursts with considerable violence. The origin of various size groups of fragments and its significance in determining the observed size distribution has been noted. An experimental arrangement is described that permits a large number of photographs to be taken of all stages of disintegration. A.

MOLECULAR THEORY OF LIQUIDS 532.7

532.7

1111. DETERMINATION OF THE ORIENTATIONAL RELAXATION TIME FOR A SERIES OF LIQUIDS FROM THE SCATTERING LINE-WIDTH. M.F.Vuks and A.K.Atakhodzhaev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 5, 926-8 (1956). In Russian.

Light from a mercury lamp was scattered by the liquid specimens and the spectra of incident and scattered radiation were recorded photographically and photometered to give line-widths. The three lines at 4358, 4347 and 4339 A have intensities in the ratios 1 : 1/18 : 1/58. The widths of the scattered lines were measured where the intensity had fallen to 1/3.2, 1/18 and 1/58 of the peak height. The relaxation time was given by $(n-1)^{1/2}/2\pi\,\Delta\nu_n$ where $\Delta\nu_n$ is the width of the line where its intensity has fallen to 1/n of the peak value. n = 18 was found to give the best results as the wings of the lines are not due to relaxation processes. About 20 liquids were studied. A.L.Mackay

532.7 : 534.22

1112. ON VOLUME VISCO-ELASTIC THEORY OF FLUIDS AND ITS APPLICATION TO SOUND DISPERSION PHENOMENA. H.-F.Lu.
Scientia Sinica, Vol. 5, No. 1, 33-48 (March, 1956).

It is shown that the volume viscoelastic theory of fluids is not merely applicable to the case of structural relaxation, but equally applicable to all three kinds of relaxations — thermal, structural and chemical. From an equation of irreversibility of volume change is inferred the equation of thermal irreversibility as originally assumed by Herzfeld and Rice for the case of thermal relaxation. Also, in the case of chemical relaxation, the equation of irreversibility of volume change is shown to imply the equation of chemical irreversibility as obtained from kinetic considerations by Liebermann. Regarding the application of this theory to sound absorption and dispersion phenomena, Bourgin–Kneser equations for the case of thermal relaxation and the Liebermann equation for the case of chemical relaxation are shown to follow directly from the results of the theory of compressibilities when appropriate thermodynamic considerations have been made. This derivation reveals that the Liebermann equation of sound absorption can be a good approximation only for the case of liquids. In the case of gases, illustrations are given in which the existing sound absorption and dispersion measurements are already accurate enough to make it possible to determine from them the static and instantaneous compressibilities β_0 and β_∞ and hence the two ratios of heat capacities γ_0 and γ_∞ as well as the external and internal heat capacities $C^{(e)}$ and $C^{(i)}$, thus subsequently enabling us to draw directly from them certain conclusions regarding the structure of the molecule and the processes of energy exchanges upon collision. Finally, the appropriateness of the definition of volume viscosity is discussed. A.

532.7 : 539.213

1113. DEPENDENCE OF THE KINETIC PROPERTIES OF LIQUIDS AND GLASSES ON TEMPERATURE, PRESSURE AND VOLUME. N.I.Shishkin.
Zh. tekh. Fiz., Vol. 26, No. 7, 1461-82 (1956). In Russian.

The author follows Frenkel in considering the mechanism to be of the same kind fundamentally in liquids and in solids. Formulae may be derived which express the dependence of these kinetic properties upon external conditions, applicable alike to liquids, crystalline solids and glasses, e.g. relaxation time, viscosity, electrical resistivity, diffusion coefficient. The treatment of activation energy problems follows Eyring. The qualitative connection between an intermolecular interaction and the activation energy of kinetic processes taking place in liquids and solids is studied theoretically and experimentally. C.R.S.Manders

532.783

1114. LIQUID-CRYSTALLINE STRUCTURES IN SOLUTIONS OF A POLYPEPTIDE. C.Robinson.
Trans Faraday Soc., Vol. 52, Pt 4, 571-92 (April, 1956).

The birefringent solutions of poly-γ-benzyl-L-glutamate in several solvents have been studied. These show parallel equidistant lines which are visible even in natural light. The periodicity of these lines, which is concentration dependent, may exceed 100 000 A. The structure is also associated with very high optical rotatory power and is therefore reminiscent of that formed by the cholesteric type of liquid crystals, but there are some features, including the appearance of visible spirals and radial lines of dislocation, which have not been observed in cholesteric liquid crystals. A model of the structure is tentatively put forward, but further investigation will be required before these solutions are fully understood. A.

MECHANICS OF GASES 533

533.16

1115. MEASUREMENTS ON THE VISCOSITY OF Ne–A MIXTURES BETWEEN 300 AND 70°K. A.O.Rietveld and A.van Itterbeek.
Physica, Vol. 22, No. 9, 785-90 (Sept., 1956).

Measurements were made using the oscillating disk method at 291.1, 229.0, 193.4, 90.3 and 72.3°K. At each of these temperatures a viscosity coefficient–concentration curve was determined. These curves are also calculated theoretically from the formulae and tables given by Hirschfelder, Curtiss and Bird. The agreement is good. A.

533.275

1116. DIFFUSION HYGROMETER. B.V.Deryagin, P.S.Prokhorov, G.A.Batova and L.F.Leonov.
Zh. tekh. Fiz., Vol. 26, No. 4, 887-94 (1956). In Russian.

Describes several types of hygrometer for which four Soviet patents were granted. The basic diffusion hygrometer contains two chambers separated by porous walls (coal, microporous rubber) from the surrounding gaseous atmosphere whose relative humidity (r.h.) is to be measured; one chamber has a constant humidity (0 or 100%), the other is the compensation chamber with atmospheric pressure. The two chambers are connected to two arms of a differential manometer (or micro-manometer). In order to eliminate the dependence of the hygrometer constant on temperature and pressure, a three-chamber model was designed, containing a 0% r.h., a 100% r.h., and a compensation chamber. A diffusion hygrometer with a small lag and high sensitivity comprises a micro-manometer and a negative feedback based on the displacement of the manometer bubble. It is claimed that the lag is reduced to 1 – 2 sec. Diffusion hygrometers can be used for determining humidity even below 0°C, in flow as well as in stationary gas; the scale is linear. See also Helv. phys. Acta., Vol. 17, No. 6, 437-54 (1944). F.Lachman

533.5 : 531.788

1117. THEORY AND DESIGN OF AN ACOUSTIC PRESSURE GAUGE. W.Millar.
Atomic Energy Res. Establ. (Harwell) Mem. No. GP/M 190, 11 pp. (1956).

In the pressure range 10^{-2} to 10^3 mm mercury, a number of well-established types of gauge are in use. These include manometers (mercury or oil), McLeod gauges, Pirani gauges, and comparison devices using a mechanical diaphragm. Each of these types has its own limitations in convenience, accuracy or working range. A type of gauge is proposed here in which these limitations could be less serious, and which will cover the whole of the above range. Operation of the instrument depends on the amplitude of received signal at the end of an "acoustic transmission line", which is simply a tube containing gas at the pressure to be measured. A simple form of the gauge has already been constructed, which works well for air; design proposals are given for a gauge of general applicability. A.

533.5

1118. AUTOMATIC TOEPLER PUMP OF IMPROVED DESIGN. G.Urry and W.H.Urry.
Rev. sci. Instrum., Vol. 27, No. 10, 819-20 (Oct., 1956).

The construction and operation of a compact automatic Toepler pump of the mercury piston type which has many advantages over previous designs are described. The mercury motion is controlled by a switching relay activated by electrodes so placed at the ultimate of its stroke the air leak to the lower mercury reservoir is closed and an oil vacuum pump is started to evacuate it, and at the bottom stroke the vacuum pump is stopped and the air leak opened to allow the mercury to rise in the piston chamber. Pumping action is effected by two glass valves with conically ground seats in series in the gas inlet and outlet tubes. A.

533.59 : 537.534.3

1119. A SIMPLE, VACUUM LEAK DETECTOR USING A RADIO-FREQUENCY MASS SPECTROMETER. P.F.Váradi and L.G.Sebestyén.
J. sci. Instrum., Vol. 33, No. 10, 392-4 (Oct., 1956).

In the pressure range of 10^{-3}-10^{-7} torr leaks of the order of 2.8×10^{-8} l. torr/sec can be detected. The instrument may also be used as a conventional ionization manometer. A brief description of the principles and some details of the construction of the tube and of the portable electronic equipment are given. A.

533.59

1120. COPPER AS A HIGH-VACUUM MATERIAL. I. W.Espe.
Nachrichtentechnik, Vol. 6, No. 8, 355-64 (Aug., 1956). In German.

An excellent compilation of the physical constants of copper, especially those useful in connection with vacuum design. The use of oxygen-free high-conductivity copper is emphasized. Uses of copper in vacuum technique are discussed. A technique for casting W anticathode disks into copper blocks by double-stage vacuum casting is described in some detail. A bibliography of 66 items is included. A.H.W.Beck

533.6.01 : 534.222.2

1121. TWO-DIMENSIONAL SINK FLOW OF A VISCOUS, HEAT-CONDUCTING, COMPRESSIBLE FLUID; CYLINDRICAL SHOCK WAVES. T.Y.-T.Wu.
Quart. appl. Math., Vol. 13, No. 4, 393-418 (Jan., 1956).

The Navier–Stokes equations are given for the cylindrical sink flow of a viscous, heat-conducting, perfect gas, and the qualitative properties of the solutions together with a detailed calculation are discussed for the case of a flow of large Reynolds number. Solutions belonging to the supersonic branch all contain cylindrical shock-type flow in the transonic region of flow; these solutions gradually deviate from the inviscid supersonic branch, reach a minimum and then approach asymptotically the viscous subsonic branch. The results for shock strength and shock thickness are quite different from those of plane normal shock. Entropy variation of the fluid and the effect due to variation of viscosity coefficients are discussed. J.S.G.Thomas

533.6.08

1122. ABSOLUTE LOW SPEED ANEMOMETER. R.E.Walker and A.A.Westenberg.
Rev. sci. Instrum., Vol. 27, No. 10, 844-8 (Oct., 1956).

An absolute anemometer suitable for measurements in gases under a wide variety of conditions is described. The instrument, based on an idea first used by Kovasznay, utilizes the temperature fluctuations in the wake of a sinusoidally heated fine wire as tracer. A second hot-wire detects the fluctuations, and the phase change between two successive positions of this wire can be used to determine the free stream velocity. The technique is shown to have good spatial resolution and an accuracy better than 2% in the velocity range 40-400 cm/sec. Sources of error and various experimental conditions are discussed in detail. A.

MOLECULAR THEORY OF GASES 533.7

533.7 : 539.133

1123. COMBINATION RULES FOR POTENTIAL PARAMETERS OF UNLIKE MOLECULES ON EXP-SIX MODEL. B.N.Srivastava and K.P.Srivastava.
J. chem. Phys., Vol. 24, No. 6, 1275-6 (June, 1956).

Mason's semi-empirical rules (Abstr. 4268/1954) are modified to give better agreement with experimental data for inert gas mixtures. The third rule involving parameter A is replaced by a geometric mean rule for ϵ_{12}. The temperature dependence of viscosity, thermal diffusion, etc. provide a more critical test of the accuracy of the parameters than do the absolute values. G.Allen

533.7

1124. THE TRANSPORT PROPERTIES AND THE EQUATION OF STATE OF GASEOUS PARA- AND ORTHO-HYDROGEN AND THEIR MIXTURES BELOW 40°K.
E.G.D.Cohen, M.J.Offerhaus, J.M.J.van Leeuwen, B.W.Roos and J.de Boer.
Physica, Vol. 22, No. 9, 791-815 (Sept., 1956).

Using a spherically symmetrical Lennard-Jones potential field, the following properties of para-H_2, ortho-H_2 and their mixtures were quantum-mechanically calculated: (1) viscosity and heat conductivity, with special attention paid to the dependence of viscosity on the para-ortho concentration ratio; (2) coefficients of self-diffusion and of mutual diffusion; (3) thermal diffusion ratio; (4) second virial coefficient. The agreement between experiment and the calculated viscosity and heat conductivity coefficients is good. The calculations on the concentration dependence of viscosity show that pH_2 has a greater viscosity than nH_2, contrary to previous theoretical predictions, but in accordance with the measurements of Becker and Stehl and Van Itterbeek and Coremans. A similar effect in the second virial coefficient must be negligibly small, according to both experiment and theory. The second virial coefficient itself is about 10% smaller than the experimental value, which is probably due to the non-spherical character of the real potential field. A.

533.7 : 535.325

1125. THE MOLECULAR REFRACTION OF AN IMPERFECT GAS. A.D.Buckingham.
Trans Faraday Soc., Vol. 52, Pt 6, 747-53 (June, 1956).

The molecular refraction of a compressed gas is expanded in powers of the density, and the leading term representing a departure from ideal behaviour is examined in detail. The effects of anisotropy in the polarizability and of permanent quadrupole moments are discussed in a treatment of non-polar molecules. For polar ones the influences of anisotropy and of the dependence of polarizability on the electric field strength are considered. It is suggested that the last-mentioned effect may be dominant for some molecules. A.

533.75

1126. THE SECOND VIRIAL COEFFICIENT OF GASES AND MIXTURES. I. CARBON DIOXIDE + HELIUM MIXTURES.
T.L.Cottrell and R.A.Hamilton.
Trans Faraday Soc., Vol. 52, Pt 2, 156-60 (Feb., 1956).

This paper describes an apparatus for the measurement of the second virial coefficient of gases, vapours, and mixtures at pressures less than 1 atm, with an accuracy of $\pm$ 5 cm^3 $mole^{-1}$. It differs from the usual "Boyle's apparatus" in that the gas under measurement is not in contact with mercury. The second virial coefficients of carbon dioxide and of an equimolecular mixture of carbon dioxide and helium have been measured at 30, 60 and 90°C. A.

VIBRATIONS. ACOUSTICS 534

534.014.5 : 538.114

1127. AN ERROR IN A THEORETICAL ANALYSIS OF FERRORESONANCE PHENOMENA AT A FREQUENCY EQUAL TO ONE THIRD THE FREQUENCY OF THE FORCING FIELD. A.N.Bakhrameev.
Zh. tekh. Fiz., Vol. 26, No. 8, 1862 (1956). In Russian.

Remarks on C.Hayashi's work (Abstr. 3447, 5336/1953; 1793 B/1953, J.appl. Phys., Vol. 24, 344-8, March, 1953).

534.21

1128. VISUAL DISPLAY OF SONIC AND ULTRASONIC WAVES. F.Canac.
Onde élect., Vol. 36, 422-7 (May, 1956). In French.

534.213

1129. DISTORTION AND INTERACTION OF SOUND WAVES OF FINITE AMPLITUDE IN A VISCOUS MEDIUM. G.D.Mikhailov.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 1, 68-71 (1956). In Russian.

Starting with the equation of continuity, the equation of motion (including bulk and shear viscosity), and the equation of state in isentropic form, the usual acoustic equations are derived. The sound pressure is calculated when the medium is viscous and is excited at one frequency and also for the case of excitation with two different frequencies. For small viscosity and small distances from the source, for small viscosity and large distances for source, and for viscosity in original equations only of second order of smallness the expressions for sound pressure take on familiar forms. It is claimed that there is qualitative agreement between theoretical and experimental results. C.R.S.Manders

534.213

1130. DISTORTION IN THE FORM OF ULTRASONIC WAVES OF FINITE AMPLITUDE IN LIQUIDS. L.K.Zarembo, V.A.Krasil'nikov and V.V.Shklovskaya-Kordi.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 485-8 (1956). In Russian.

The fundamental frequency used is 1.5 Mc/s radiated from a transducer 2.5 cm in diameter. Receivers are used at frequencies of 1.5, 3 and 4.5 Mc/s followed by appropriate tuned amplifiers, each with a bandwidth of 100 kc/s. The amplitudes of the second and third harmonics of the radiated wave are measured at various distances from the radiating crystal. Curves are plotted and compared with simple theoretical predictions for the harmonic content of a wave having large amplitude. The liquid used is water, measurements are taken up to a distance of 60 cm from the transmitter. The total input power available is 350 W. The effect of introducing an acoustic filter in the transmission path is also studied. S.C.Dunn

534.213

1131. ON THE QUESTION OF INTERACTION OF ULTRASONIC WAVES IN FLUIDS. G.D.Mikhaĭlov.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1142 (1956). In Russian.

A quartz crystal plate 20 mm dia. radiates into vaseline oil. Each half of its area is excited at a different frequency. The receiver is a barium titanate disc. When the driving frequencies are 1.0 and 1.5 Mc/s an output is observed at 2.5 Mc/s. The variation in the magnitude of this output is plotted against distance from the source for two radiated intensities which are in the ratio 2 : 1. It is concluded that there is a marked maximum in the intensity of the combination wave at a certain distance from the source, that the position of this maximum is independent of radiated intensity and that the position is probably a measure of the viscosity of the fluid. S.C.Dunn

534.22 : 532.73

1132. VELOCITY OF SOUND IN THE LIQUID MIXTURE CCl_4–$C(CH_3)_4$. J.Jeener.
J. chem. Phys., Vol. 25, No. 3, 584-5 (Sept., 1956).

A standard ultrasonic interferometer was used to measure the velocity of sound at 0°C in the mixtures (mole fraction of CCl_4, 0.84, 0.6, 0.4). The variation of velocity with pressure was investigated and the results extrapolated to zero pressure. The velocity of sound in pure CCl_4 from −10° to 10°C and $C(CH_3)_4$ from −5° to 5°C is also reported. From these data $(\partial v/\partial p)_T$ and the excess function $(\partial v_E/\partial p)_T$ are calculated for the mixtures at 0°C. The value obtained for $(\partial v_E/\partial p)_T$ agrees with the value predicted by Prigogine's new theory of solutions. G.Allen

534.22

1133. THE VARIATION OF SOUND VELOCITY WITH STRESS IN SAND. E.Matsukawa and A.N.Hunter.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 847-8 (Aug., 1956).

During the course of investigations into the propagation of sound in granular materials, it has been found that the velocity and attenuation of sound in dry sand are markedly dependent on the load applied to the sand. For example, an increase of load from 0.2 to 3.0 lb per in.^{2} applied in the direction of sound propagation resulted in an increase of velocity from 160 to 300 metres/sec, the measurements being made at 20 kc/sec by a pulse method. No appreciable dispersion was noticed as the frequency was varied between 10 and 50 kc/sec. The experimental results are compared with Grassman's theory (Geophysics, Vol. 16, 673, 1951). This suggests that the velocity is independent of granule size, but this is not in agreement with the authors' observations. The experiments indicate that velocity increases and attenuation decreases with increase of load in the direction of propagation. When the load is applied at right angles to the direction of propagation the converse is true. A.B.Wood

534.22 : 532.7

APPLICATION OF VOLUME VISCOELASTIC THEORY OF FLUIDS TO DISPERSION PHENOMENA. See Abstr. 1112

534.222.2 : 539.374

1134. SHOCK WAVES IN A PLASTIC COMPRESSIBLE MEDIUM. A.S.Kompaneets.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 1, 49-52 (1956). In Russian.

Presents the solution of the problem of shock propagation of the plastic deformation in a medium (e.g. sand) which, initially, has the density ρ_0 and offers a negligible resistance to compression whereas at the density ρ_1 it becomes incompressible and plastic (Prandtl's condition of plasticity). F.Lachman

534.222.2

1135. SHOCK PRODUCED BY A SPHERICAL PISTON OF RADIUS a(t). G.W.Evans,II, F.D.Faulkner, B.J.Lockhart and C.L.Perry.
J. appl. Phys., Vol. 27, No. 11, 1345-51 (Nov., 1956).

The numerical solution for a spherical shock in water produced by spherical piston of known expanding motion and initial nonzero radius is described. This solution is of interest during the time when the radius of the shock and that of the piston are of the same order of magnitude, that is, when point source solutions do not hold. Calculations are carried out for a constant velocity piston and for a piston with decreasing velocity. A.

534.222.2

1136. SHOCK WAVES IN ELASTIC AND ELASTIC-PLASTIC MEDIA. K.B.Broberg.
K. Tekn. Högsk. Avhandl., No. 111, 141 pp. (1956).

This paper is a review of a present position and covers the literature plus experimental work done by the author. It is mainly concerned with the propagation of shock waves through metals, but some paragraphs deal with rock. The types of wave resulting from the detonation of a cylindrical charge against a plane surface and the impact of a sphere on such a surface are described and considered theoretically. The next section deals with the properties of the target materials and particular reference is made to the conditions under which they cease to behave elastically. The propagation of elastic waves is then considered, the waves discussed being plane, cylindrical and spherical. Sections deal with waves in a semi-infinite medium, in an elastic half-space having its surface subjected to an impulsive line or point load, in an elastic half-space subjected to impact by a sphere and an explosive charge, in a steel plate struck by a sphere and a plate subjected to an explosive charge. The propagation of shock waves in an elastoplastic medium is then discussed with special reference to detonation of a charge in contact. Reflections of shock waves are also considered and illustrated by such phenomena as spalling and scabbing. A.C.Whiffin

534.222.2 : 533.6.01

SHOCK WAVES IN VISCOUS COMPRESSIBLE GAS. See Abstr. 1121

534.23 : 681.142

1137. ON THE MEASUREMENT OF ATTENUATION IN ULTRASONIC DELAY LINES. M.Redwood and J.Lamb.
Proc. Instn Elect. Engrs, Paper 2194 R, publ. Nov., 1956 (Vol. 103 B, 773-80).

A theoretical and experimental study has been made of the effects of coupling films on the propagation of compressional waves from a transducer to a solid medium. In practice it has been found that "wringing" the transducer to the specimen with oil as a coupling medium produces a film of non-uniform thickness. Although the variations in thickness are of the order of a wavelength of light, these variations are important at ultrasonic frequencies in the region of 50 Mc/s and above. Conditions are described under which such films can lead to the propagation of a predominantly first-order mode in the specimen, resulting in an exponential decay of the amplitudes of successive reflections, with a consequent improved accuracy of attenuation measurement. A.

534.23 : 533.6.011

1138. SOUND TRANSMISSION FROM A TUBE WITH FLOW. G.F.Carrier.
Quart. appl. Math., Vol. 13, No. 4, 457-61 (Jan., 1956).

The increasing technological importance of thermoacoustic phenomena in combustion chambers requires a knowledge of the mechanism of transmission and reflection of acoustic waves at the inlet and exit sections of tubes through which gas is flowing at moderate Mach number. In the present paper the author deals mathematically with this problem for an inviscid perfect gas. The problem is resolved by an extension of the work of Schwinger and Levine (Abstr. 1181/1948). Modifications of their work are reminiscent of subsonic aerodynamic results obtained by using the Prandtl–Glauert method. A.B.Wood

534.23

1139. SOUND ABSORPTION IN LIQUIDS: THERMAL METHODS. S.Parthasarathy, M.Pancholy and S.S.Mathur.
Ann. Phys. (Leipzig), Vol. 18, No. 3-4, 220-4 (1956).

The thermal method developed at the authors' laboratory for the measurement of the ultrasonic absorption coefficient in liquids has been used elsewhere in a modified form. Re-examination of this new technique reveals that it is not capable of giving a value for the ultrasonic absorption coefficient of liquids. A.

534.23

1140. THE ABSORPTION OF ULTRASONIC WAVES OF FINITE AMPLITUDES IN LIQUIDS. L.K.Zarembo, V.A.Krasil'nikov and V.V.Shklovskaya-Kordi.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 731-4 (1956). In Russian.

A 350 W generator was used to excite a submerged quartz crystal oscillator at 1.5 Mc/s and could produce an intensity of 18 W/cm^2 near the crystal. Using a Cu–constantan thermocouple embedded in soft resin as a detector, the absorptions of methyl and ethyl alcohols, toluol, water, glycerine, transformer oil and formic and acetic acids (80%) were measured. Increase in the coefficient of absorption with intensity was much less for the more viscous liquids. Subsidiary experiments with an increased external pressure showed the influence of cavitation to be inappreciable. The observed absorption is greater than that calculated by Fox and Wallace but the change in absorption is of the form predicted by their theory (Abstr. 1621/1955). A.L.Mackay

534.23

1141. FREQUENCY DEPENDENCE OF ULTRASONIC ATTENUATION IN GERMANIUM. A.Granato and R.Truell.
J. appl. Phys., Vol. 27, No. 10, 1219-26 (Oct., 1956).

The attenuation of compressional waves travelling in the [100] direction in germanium has been measured in the frequency range from 5 to 300 Mc/s. Below 20 Mc/s, the loss was found to be mostly due to diffraction. The remaining attenuation can be described by an expression of the form $\alpha = Kf^n$, where α is the attenuation, f the frequency, n a constant near but somewhat less than two, and K a constant. The attenuation is attributed to the damped forced oscillation of dislocation segments. The value of the damping constant found from the data (about 1.1×10^{-4} g sec^{-1} cm^{-1}) is in agreement with the estimate of Leibfried and Nabarro. A.

534.23

1142. THE KIRCHHOFF–HELMHOLTZ ABSORPTION OF AUDIBLE SOUND IN CYLINDRICAL TUBES. P.Mariens, A.van Itterbeek and P.Godenir.
Meded. K. Vlaamse Acad. Wetensch., Vol. 16, No. 7, 1-15 (1954). In Flemish.

The attenuation constant in air of acoustic amplitudes has been measured, for pressures from 2.3 to 0.18 atm. in a cylindrical tube of 5.16 cm dia. and in cylindrical capillary tubes of 0.10 cm and 0.15 cm dia. In the first series of measurements the amplitude of stationary waves in the wide tube is measured as a function of distance to the end, and the attenuation constant calculated. On an average the experimental attenuation constant is 12% higher than the constant calculated with the Kirchhoff–Helmholtz theory. In the second series of measurements the measuring tube is closed by a sample of capillary tubes; the absorption coefficient and the phase difference at the input of the samples are measured and from that the attenuation in the capillary tubes is calculated. It is again found that the theoretical values of Kirchhoff–Helmholtz are 14% lower than the mean experimental ones. A.

534.23 : 532.7

1143. THE ABSORPTION OF ULTRASONIC WAVES IN A NUMBER OF PURE LIQUIDS OVER THE FREQUENCY RANGE 100 TO 200 Mc/s. E.L.Heasell and J.Lamb.
Proc. Phys. Soc. B, Vol. 69, Pt 9, 869-77 (Sept., 1956).

The absorption of a sound wave in a liquid is conveniently represented by the quantity α/f^2 where α is the absorption coefficient relating to the excess pressure and f is the frequency. Values of α/f^2 are given in the paper for ninety-four liquids at a temperature of 25° C. The measurements were made by the pulse method at frequencies between 100 to 200 Mc/s and are estimated to be accurate to within ±2%. The essential features of the apparatus are described. The results are reviewed in the light of existing knowledge concerning the mechanisms responsible for attenuation of a sound wave in a liquid. A.

534.23 : 532.7

1144. ULTRASONIC RELAXATION PROCESSES IN LIQUID TRIETHYLAMINE. E.L.Heasell and J.Lamb.
Proc. Roy. Soc. A, Vol. 236, 233-44 (Oct. 9, 1956).

Measurements have been made of the velocity of propagation and the absorption of ultrasonic waves in liquid triethylamine over the temperature range 25 to 70° C and at frequencies of approximately 23, 66, 107, 148 and 192 Mc/s. The absorption results demonstrate the existence of a relaxation process which is attributed to the perturbation by the sound wave of an equilibrium between rotational isomers. The activation energy barrier and the difference in energy between the states are evaluated from an analysis of the results. The calculated dispersion of velocity is less than 1%. Values of the specific heat of triethylamine are required in the analysis and are given for the temperature range 25 to 60° C. The results are discussed in the light of other measurements concerned with rotational isomers. A.

534.23 : 532.7

1145. ABSORPTION MEASUREMENT OF ULTRASONIC WAVES IN WATER AND ELECTROLYTIC SOLUTIONS. L.Van Craeynest.
Verhandl. K. Vlaamse Acad. Wetensch., No. 49, 50 pp. (1955). In Flemish.

The measurements were made by means of a radiation pressure method in the frequency range 1.5-5 Mc/s. The values of $2\alpha/\nu^2$ obtained with measurements in water, at temperatures between 5 and 50° C, agree well with those obtained by Pinkerton in the frequency range 7-70 Mc/s. Investigations in $MgSO_4$ solutions at frequencies of 1.5 and 2.5 Mc/s and temperatures of respectively 20, 30, 40 and 50° C showed an absorption proportional to the concentration. Relaxation is seen, but the frequencies used were too high to permit an exact calculation of the relaxation time. The results are in agreement with those of Kurtze and Tamm, who measured in a frequency range 50-500 kc/s. Further measurements were made in solutions of copper acetate at frequencies of 1.5, 3 and 5 Mc/s and temperatures of 22, 30 and 40° C. The absorption was found to be linear with the concentration up to 0.1 mol/l. The relaxation frequency was calculated at the different temperatures. The results differ much from the known relaxation frequencies of sulphates; there is more agreement with the values obtained for acetic acid by Lamb and Pinkerton. No interpretation of the results has been given till now; more investigations in other acetates should be made to give a due explanation of the absorption mechanism. A.

534.26 : 535.43 : 538.566

1146. ON THE SCATTERING OF SPHERICAL WAVES BY A CYLINDRICAL OBJECT. J.R.Wait.
Appl. sci. Res. B, Vol. 4, No. 6, 464-8 (1955).

The connection between plane wave and spherical wave scattering from an infinitely cylindrical object is investigated. If the distance of the source and the observer from the axis of the cylinder are denoted by ρ_0 and ρ, respectively, the ratio of the scattered field to that for plane wave excitation $[\rho_0/(\rho_0+\rho)]^{1/2}$. A.

534.39

1147. RADIATION PRESSURES AND THEIR TENSORIAL ASPECT. L.Brillouin.
J. Phys. Radium, Vol. 17, No. 5, 379-83 (May, 1956). In French.

Emission, absorption and reflection of elastic waves result in forces known as radiation pressure. For an unperturbed plane wave it is possible to compute the average tensor of stresses, from which the force on any obstacle can be obtained. This fundamental tensor is discussed first for a non-dispersive medium and second for a dispersive medium. Some examples and applications are given. The problem of scattering by a sphere is of special interest, and its discussion leads to a correct definition of the scattering cross-section. A.

534.39

1148. ON RADIATION PRESSURE IN ACOUSTICS. O.K.Mawardi.
J. Phys. Radium, Vol. 17, No. 5, 384-90 (May, 1956). In French.

A critical survey for the development of the concept of radiation pressure is presented. In this survey, first resti

ed to an ideal inviscid fluid, the tensorial character of the radiation pressure is pointed out and its connection with the flux of momentum associated with the wave is studied. It is also shown that the two common definitions of radiation pressure (Langevin and Rayleigh) are closely related and naturally follow from the above mentioned tensor property. The discussion is then extended to the case for a viscous fluid. The interaction of sound waves and rigid obstacles of simple geometrical shapes is also discussed. The radiation pressure on these obstacles is computed for some limiting cases and the relation between the radiation pressure and the scattering cross-section for these obstacles is investigated. A review of the better known methods of experimentally measuring the radiation pressure is next given. The comparative merit of these techniques as far as accuracy of measurements is concerned has been examined in the light of the discussion of this paper. 27 refs. A.

534.39

1149. ACOUSTIC RADIATION PRESSURE. E.J.Post.
J. Phys. Radium, Vol. 17, No. 5, 391-4 (May, 1956). In French.

In the phenomenological descriptions of classical physics there are three interconnected problems requiring a clear interpretation: (1) acoustic radiation pressure; (2) relations between Euler and Lagrange equations, and their application to turbulent motions; (3) electromagnetic theory of Minkowski for a moving medium, and the definition of momentum and tension or electromagnetic radiation pressure in a material medium. Using the relativistic theory as the most general description, first-order transformations are discussed in the present paper. Transformation equations are independent of the properties of the medium. Physical interpretation suggests semi-permeable walls, which lead to a distinction between two terms in acoustic radiation pressure. The nature of phonons or photons is more precisely specified. A.

534.39

1150. THE TENSIONS OF RADIATION IN ACOUSTICS. R.Lucas.
J. Phys. Radium, Vol. 17, No. 5, 395-9 (May, 1956). In French.

Stresses resulting from the propagation of a plane elastic wave through a fluid can be computed by a method similar to the one used in elasticity for stresses in a strained solid body. This discussion proves the anisotropic character of the forces acting on the boundaries and their tensorial nature. The radiation tensor for a spherical wave is different from the tensor for a plane wave. Using the Boltzmann–Ehrenfest adiabatic invariants, it is possible to prove the existence of an isotropic pressure term, which can be discussed experimentally. The method of radiation tensors can be used to compute the pressure in an ideal monatomic gas, or the osmotic pressure in a solution. Both examples are completely discussed. A.

534.39

1151. FORCE ACTING ON A SPHERE SUSPENDED IN A SOUND FIELD. A.Johansen.
J. Phys. Radium, Vol. 17, No. 5, 400 (May, 1956). In French.

The best way, in calculating the force acting on any surface in a sound field, is to consider the flow of momentum in the field. In the case of a rigid sphere, suspended in the field of an infinite plane wave, the problem can be accurately worked out. A.

534.39

1152. RADIATION PRESSURE IN FLUIDS. J.Mercier.
J. Phys. Radium, Vol. 17, No. 5, 401-4 (May, 1956). In French.

The computation of radiation pressure can be done on progressive waves absorbed by an obstacle, and gives both the average and instantaneous values. It is a tensor, and for a plane wave it is measured by the energy-density U on the obstacle or by the product $u.\Delta p/V$, where Δp is the excess pressure, u the acoustic velocity of the particles and V the wave velocity. The last formula is more general than the first one. A.

534.39

1153. ACOUSTIC STREAMING AND RADIATION PRESSURE. [illegible] Piercy.
[illegible]s. Radium, Vol. 17, No. 5, 405-10 (May, 1956). In [illegible]h.

A phenomonological view is presented that links acoustic [illegible]entum, radiation pressure and streaming. The technique of measurements of radiation pressure is discussed in the light of this view. Thus the steady force on a paddle in a plane wave sound field is shown to be strongly dependent on the configuration of the medium outside the sound field. An apparatus is described which gives the sound absorption coefficient from measurement of small differences in the static pressure. The principle of operation of this apparatus is essentially new and is based on a gradient of static pressure which is associated with an opposite gradient of radiation pressure. Sound absorption coefficients between 0.0002 and 0.1 cm^{-1} may be measured in the frequency range 1 to 10 Mc/s. A.

534.39

1154. PROCEDURE FOR THE CALIBRATION OF AN ACOUSTIC PROBE BY MEANS OF AN ABSOLUTE PENDULUM FOR RADIATION PRESSURE. C.Florisson.
J. Phys. Radium, Vol. 17, No. 5, 411-12 (May, 1956). In French.

534.39 : 537.311.33

ACOUSTODYNAMIC EFFECTS IN SEMICONDUCTORS. See Abstr. 1276

534.6

1155. ULTRASONIC STROBOSCOPES FOR THE STUDY OF ULTRASONIC FIELDS. W.L.Gessert and E.A.Hiedemann.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 944-50 (Sept., 1956).

The possibilities and limitations of different ultrasonic stroboscopes described by Bär for the special purpose of studying ultrasonic phenomena were investigated in greater detail. One type is appropriate for the measurement of the velocity of propagation of progressive ultrasonic waves. A modified setup offers special advantages for the precise determination of the sound velocity in a liquid relative to a standard liquid. Another optical arrangement is best suited for the study of ultrasonic fields; it was used for direct measurements of the Rayleigh phase-shift at a liquid–liquid interface and for photography of the phase field before an ultrasonic transducer. A.

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85.

534.784

1156. AN ANALYSING EQUIPMENT FOR THE ZERO-CROSSING INTERVAL AND ITS APPLICATION TO SPEECH ANALYSES. T.Sakai and S.Inoue.
J. Inst. Elect. Commun. Engrs Japan, Vol. 39, No. 4, 404-9 (April, 1956). In Japanese.

The equipment is designed for statistical digital analysis of the zero-crossing interval of any time function. In speech analysis, the input voice signal is amplified and converted to rectangular waves which are used to trigger a pulsed Hartley oscillator, the pulse train of which drives a 2-stage Dekatron counter during the interval between two successive points of zero-crossing. The zero-crossing intervals of speech sounds are classified into 14 channels. The results show the possibility of a simpler method of sound analysis. A new time-domain filter developed for the equipment has a very sharp cut-off characteristic. A.Wilkinson

534.833

1157. ACOUSTIC INSULATION OF HEAVY STRUCTURE. F.Pujolle.
Onde élect., Vol. 36, 435-40 (May, 1956). In French.

Tests were carried out in a special building constructed for this purpose, and consisting of a number of combinations of 2 and 3 walls of bricks with cement ties. The importance of indirect transmission was demonstrated when high insulation structures are used. The chosen structure consisted of 3 walls 20 cm thick and separated by 2 air gaps of 15 cm bonded with cement ties, and clamped with mineral wool. A.

OPTICS. RADIATION. SPECTRA 535

535.13

1158. REFLECTION AND REFRACTION AT OBLIQUE INCIDENCE ON A DIELECTRIC–METALLIC INTERFACE AS A BOUNDARY VALUE PROBLEM IN ELECTROMAGNETIC THEORY. A.I.Mahan.
J. Opt. Soc. Amer., Vol. 46, No. 11, 913-26 (Nov., 1956).

A more comprehensive treatment of the general problem of reflection and refraction at oblique incidence on a dielectric—metallic interface is given from the viewpoint of classical electromagnetic theory for which the media involved are homogeneous and isotropic and have arbitrary values for the dielectric constant, permeability, and conductivity. Particular stress has been placed on determining the amplitudes, absolute phases, wave forms, and the time averages of the energy flow in the incident, reflected, and refracted electromagnetic waves. The fractions of the time average of the incident radiant flux contained in the reflected and refracted electromagnetic waves are also evaluated and show that the energy flow is continuous across the boundary. The general approach of Konig has been used in which the properties of inhomogeneous waves are first discussed and then utilized in determining the forms of the incident, reflected, and refracted electromagnetic waves. For the two initial planes of polarization of the electric vector, the refracted electromagnetic wave may be elliptical in either E or H, and the metallic medium is found to have a refractive index and extinction coefficient which are functions of the material constants and the angle of incidence. Two different laws of refraction become necessary when considering the directions of the energy flow in the refracting medium for the two initial planes of polarization of the electric vector. A.

535.222

1159. NEW METHOD OF DETERMINATION OF THE VELOCITY OF LIGHT. K.S.Vul'fson.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 5, 929-30 (1956). In Russian.

A new variant of the Fizeau method is proposed. A short-duration light pulse is reflected by a mirror onto a photoelectric receiving arrangement. An electric pulse generated in the latter causes a repeated emission of the light pulse from the source. The process is then maintained automatically. The velocity of light is determined by finding the frequency of the light pulses at several different positions of the mirror. The displacements of the mirror are small and can, therefore, be measured accurately using interferometric methods. Z.Krasucki

535.223 : 621.317.39

1160. MICROWAVE DETERMINATIONS OF THE VELOCITY OF "LIGHT". K.D.Froome.
J. Brit. Instn Radio Engrs, Vol. 16, No. 9, 497-514 (Sept., 1956).

A description of methods utilizing microwaves for the purpose of measuring the free-space vacuum velocity of electromagnetic waves. The cavity resonator and the microwave interferometer methods are discussed in detail; brief mention is made of the molecular band spectrum method. The values obtained from these methods are compared with optical values. A.

535.31

1161. SHIELDING OF RADIATION FROM A PLANE CIRCULAR SOURCE. P.M.Anselone and F.Sobel.
J. Opt. Soc. Amer., Vol. 46, No. 11, 934-40 (Nov., 1956).

The angular distribution of radiation intensity emitted from a plane circular source is altered by an attached cylindrical shield. Under the assumption of cylindrical symmetry, explicit expressions are obtained for the angular intensity distribution of the radiation emerging from the mouth of the shield. The source is characterized by an intensity which is a function of the point of emission and the direction of emission. The shield is characterized by its length-to-diameter ratio and by the reflectivity of its inner surface. The reflectivity is not necessarily uniform. The general result is an infinite series of integrals over subregions of the source area. For certain cases these integrals are evaluated in terms of elementary mathematical functions. A.

535.313.1

1162. COMPLEX AMPLITUDE DISTRIBUTION ON THE AXIS OF A SPHERICAL MIRROR USED FOR RAPID SCANNING. L.Ronchi and V.Russo.
Atti Fond. Ronchi, Vol. 11, No. 3, 250-61 (May-June, 1956). In Italian.

The complex amplitude distribution on the axis of a spherical mirror is evaluated for an incident plane wave. Diffraction effects are taken into account. The exact expression of the wave aberration at infinity is employed in place of the usual third-order term. A.

535.317.1

1163. PHASE DISTRIBUTION NEAR FOCUS IN AN ABERRATION-FREE DIFFRACTION IMAGE. E.H.Linfoot and E.Wolf.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 823-32 (Aug., 1956).

A satisfactory picture of the three-dimensional intensity distribution near focus in the aberration-free diffraction image of a monochromatic point object was first given by Zernike and Nijboer in 1949. No corresponding general picture of the phase relations between different parts of the image seems to have been worked out, although Gouy's discovery in 1890 of the so-called phase anomaly at focus aroused an interest in this topic which, as a succession of publication shows, has not decreased in the intervening 66 years. In the present paper a sharpened version of Lommel's classical analysis is applied to obtain a general picture of the phase distribution near focus and to examine in detail, in the special case of an F/3.5 pencil, its peculiarities near the geometrical focal point, the Airy dark rings and the axial nodes (points of zero intensity) of the diffraction image. The "phase anomaly" near the focus and the singular behaviour of the phase along the axis of the pencil become more readily intelligible when they are considered against the background of this general picture. A.

535.317.25

1164. MEASURE OF RESOLVING POWER OF AN OPTICAL INSTRUMENT. S.G.Rautian.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 743-5 (1956). In Russian.

The question of the number of degrees of freedom of an image formed by an optical instrument is considered. The views of G.Toraldo di Francia (Abstr. 6882/1955, 1027/1956) are subjected to criticism. It is concluded that optical instruments do not form an exception among other linear transmission systems. The difference can only be in that the number of degrees of freedom depends on the noise level; in other words, one cannot introduce a quantitative measure of resolution independent of errors of measurements. Z.Krasucki

535.317.25

1165. IS RESOLVING POWER INDEPENDENT OF WAVELENGTH POSSIBLE? AN EXPERIMENT WITH A SONIC "MACROSCOPE". A.V.Baez.
J. Opt. Soc. Amer., Vol. 46, No. 10, 901 (Oct., 1956).

The author quotes contact radiography and a scanning type microscope as two cases of resolution not being dependent upon wavelength. An experiment in sound is described showing that resolution can be obtained when the source is smaller in size than the wavelength. A possible application in the infrared region is suggested. R.W.Fish

535.317.25

1166. THE AIRY PATTERN IN SYSTEMS OF HIGH ANGULAR APERTURE. B.Richards and E.Wolf.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 854-6 (Aug., 1956).

The modifications to the Airy pattern have been investigated in both polarized and unpolarized light, when the angular aperture is wide. The results of some calculations are given and they predict that, under certain conditions, increases in resolving power beyond that given by the Airy formula may be achieved. R.W.Fish

535.317.6

1167. RESIDUAL ABERRATIONS OF CONFLECTION DOUBLETS FOR HIGH-SPEED SCANNING. L.Ronchi and A.M.Scheggi.
Atti Fond. Ronchi, Vol. 11, No. 2, 134-45 (March-April, 1956). In Italian.

The numerical results are listed in three tables; several graphs are also given, which show the behaviour of residual aberrations of a number of doublets with third-order aberration equal to zero. Moreover doublets with a small third-order aberration are considered, for which the allowable apertures are larger than those for the preceding doublets. A.

535.323

1168. REFRACTION AND DISPERSION OF THALLIUM BROMIDE IODIDE. W.S.Rodney and I.H.Malitson.
J. Opt. Soc. Amer., Vol. 46, No. 11, 956-61 (Nov., 1956).

The refractive indexes of a mixed crystal containing 45.7 mole% thallium bromide and 54.3 mole % thallium iodide were measured at three temperatures near 19, 25 and 31°C for wavelengths from 0.5770 to 39.38 μ. The data were fitted to Sellmeier dispersion equations and thermal coefficients of index were computed. Dispersion coefficients were determined at 25°. The results were compared with data on a similar crystal. A.

535.323

1169. IN CONNECTION WITH F.NECHAĬ'S ARTICLE "ON THE POSSIBILITY OF MEASURING REFRACTIVE INDICES OF CRYSTALLINE MATERIALS WITH AN ABBE-TYPE REFRACTOMETER". G.N.Rautian and B.F.Ioffe.
Zh. tekh. Fiz., Vol. 26, No. 8, 1863-4 (1956). In Russian.

Nechaĭ's article (Abstr. 8648/1956) is shown to contain several erroneous statements and conclusions. F.Lachman

535.325

1170. DISPERSION OF MICROWAVES IN ND_3. P.Swarup.
Phys. Rev., Vol. 104, No. 1, 89-90 (Oct. 1, 1956).

The dispersion of microwaves has been theoretically calculated in the case of gaseous deutero-ammonia on the basis of the Van Vleck–Weisskopf expressions for collision-broadened spectral lines, as applicable to the inversion of ND_3 molecule in its ground vibrational state. The inversion frequency lies at 1600 Mc/s which shifts to zero frequency at 9 cm pressure. Dispersion curves are plotted at various pressures and frequencies. A.

535.33.03

1171. SIMULTANEOUS LIGHT-ABSORPTION AND EMISSION MEASUREMENTS BEHIND A SHOCK WAVE. F.Harshbarger.
J. chem. Phys., Vol. 24, No. 6, 1261 (June, 1956).

The use of a Kerr cell for simultaneous measurement of emission and absorption during the decomposition of acetylene behind weak shocks is described. G.I.W.Llewelyn

535.33.07

1172. CONVENIENT CALIBRATION CURVE FOR PRISM INFRARED SPECTROMETERS. G.W.Bethke.
J. Opt. Soc. Amer., Vol. 46, No. 7, 560 (July, 1956).

The relation, between frequency ν and instrument reading T, $\nu = B\text{-}A\log(C\text{-}T)$ is convenient to handle. It is found to be reliable for KBr, CsBr and CsI; and for NaCl for 650-2000 cm^{-1} only. It is not satisfactory for NaCl at $\nu > 2000$ cm^{-1}, nor for LiF or CaF_2. G.F.Lothian

535.33.07 : 535.343

1173. NEW VARIABLE THICKNESS INFRARED CELL AND THE INFRARED SPECTRA OF HF, DF, H_2O, AND D_2O.
R.M.Adams and J.J.Katz.
J. Opt. Soc. Amer., Vol. 46, No. 10, 895-8 (Oct., 1956).

A cell which may be used for corrosive liquids such as HF or for aqueous solutions is described. The cell is constructed of Monel metal with silver chloride windows, and is variable from a few microns up to about three quarters of a millimetre in thickness. The infrared spectra of liquid HF, DF, H_2O and D_2O are given along with the absorption coefficients for the principal peaks. A.

535.33.087.9 : 518.5

1174. THE USE OF HOLLERITH COMPUTING MACHINES IN SPECTROSCOPIC TERM ANALYSIS. L.F.H.Bovey and C.W.Nott.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1334, 8 pp. (1956).

One essential step in the term analysis of spectra is the sorting of the difference between the wave numbers of the lines appearing in the emission spectrum of the element concerned. This is basically a mechanical process and a method using the existing Hollerith installations has been devised for this purpose. The method is in three stages. From the experimentally measured wavelengths, to which the corrections for conversion into equivalent wavelengths in vacuo are added, the reciprocals are obtained. Secondly, all the differences are formed and these are then sorted into groups. Attempts have been made to extend the sorting so that groups of associated lines could be found automatically. The main difficulty here is set by the error spread arising from the uncertainty in the original data. Methods devised so far need a very large number of cards with a corresponding demand on machine time. Advantages of the general method include the accuracy, complete cross-checks for any errors, the flexibility of the possible sorting procedures and the use of existing machines. The preliminary results of the application of this procedure to the analysis of the rare earth metals are briefly discussed. A.

535.331

1175. A REVISION OF THE TERM SYSTEMS FOR Na I AND K I BASED ON HOLLOW-CATHODE OBSERVATIONS. P.Risberg.
Ark. Fys., Vol. 10, Paper 41, 583-606 (1956).

By using a hollow-cathode discharge as a light source wavelengths have been determined by means of concave grating spectrographs for forty-five lines in Na I in the region 11 403-2852 A, and for seventy-nine lines in K I in the region 11 772-3101 A. On the basis of these data and those of Meissner and Luft for Na I, as well as some wavelengths determined by Johansson in the PbS region, the term systems have been recalculated, the series limits precisely determined, and accurate series formulae derived. A.

535.332 : 537.525

1176. INVESTIGATIONS USING LUMINESCING PROBES IN THE RANGE 500-1200 A. F.A Butaeva and V.A.Fabrikant.
Zh. tekh. Fiz., Vol. 26, No. 4, 749-54 (1956). In Russian.

In these experiments a discharge tube was used filled successively with He, Ne, A, Kr at pressures of about 1 mm Hg. The resonance radiations of these gases range from 584-1235 A. The probe consisted of a wire, covered with Mn-activated willemite (Zn_2SiO_4) which gives a green emission readily distinguished from the resonance radiation of the discharge. An electromagnet enabled the probe to be moved across the positive column of the discharge. The intensity of the probe's emission when excited by the resonance radiation was measured optically. Discharge currents in the tube varied from 0.01 to 1 A. Luminescent probes make it possible to determine the volume density of the radiation from the gas, the magnitude and direction of the Umov–Poynting vector and the divergence of the radiation flow at each point of the radiating volume. In the experiments it was found that the distribution of the volume density of the emission depends only to a small extent upon the nature of the gas and the discharge conditions. The ratio of the energy volume density of radiation at the edge and on the axis of the discharge enables a rough estimate to be made of the mean free paths of photons. C.R.S.Manders

535.333

1177. INTENSITIES OF BANDS IN THE SYSTEM $b^3\Sigma^+ - a^3\Pi$ OF CARBON MONOXIDE. R.F.Barrow, W.B.Gratzer and J.F.Malherbe.
Proc. Phys. Soc. A, Vol. 69, Pt 7, 574-6 (July, 1956).

Bands with $v' = 2$ in $b^3\Sigma^+ - a^3\Pi$ are, if not absent, definitely weaker than expected. If the effect arises from a predissociation, then $D_0(CO) \leq 10.94$ eV. It is, however, possible that the effect arises from a perturbation. R.F.Barrow

535.338

1178. A PROBLEM IN CONNECTION WITH THE DETERMINATION OF THE INTENSITY DISTRIBUTION IN A LINE SPECTRUM. A.Omholt.
Avhandl. Norske VidenskAkad. I. Mat.-Nat. Kl., 1955, Paper 4, 9 pp.

In spectrographs with high light power and low dispersion, using narrow slit, the line profile will be determined chiefly by the lens errors and the focusing of the plate. The profile will thus vary with wavelength, and the photometer deflection for the lines, using the ordinary H-D curve and the sensitivity curve of the plate will not give the true relative line intensity. A method is developed to compensate for this. The results of some experiments, undertaken in order to find a suitable standard lamp for this purpose, are briefly reviewed. A.

535.338.3 : 539.153

1179. THE CALCULATION OF ATOMIC ENERGY TRANSITION PROBABILITIES. R.H.Garstang.
"Vistas in Astronomy", Volume I, 268-76. See Abstr. 10 (1957).

A critical review of recent calculations on the strengths of spectral lines. Transitions permitted in Russell–Saunders coupling are discussed with particular reference to absolute strengths. Studies of the effect of departures from Russell–Saunders coupling and calculations on forbidden lines are outlined, and the difficulties of the subject characterized. An appendix gives detailed references to recent transition probabilities and atomic wave-functions. A.Beer

535.34.07

1180. A MICROWAVE SPECTROMETER FOR THE STUDY OF SPECTRA OF FREE RADICALS. W.Low and Y.Ramberg.
Bull. Res. Coun. Israel, Vol. 5A, No. 1, 40-5 (Nov., 1955).

A microwave spectrometer for the detection of spectra of free radicals is described. The spectrometer is based on Zeeman modulation technique. A detailed description of the absorption cell and assorted components is given. A.

535.34.07 : 538.3

1181. PROPOSAL FOR A NEW TYPE SOLID STATE MASER. N.Bloembergen.
Phys. Rev., Vol. 104, No. 2, 324-7 (Oct. 15, 1956).

The Overhauser effect may be used in the spin multiplet of certain paramagnetic ions to obtain a negative absorption or stimulated emission at microwave frequencies. The use of nickel fluosilicate or gadolinium ethyl sulphate at liquid-helium temperature is suggested to obtain a low-noise microwave amplifier or frequency converter. The operation of a solid-state maser based on this principle is discussed (see also Abstr. 8607/1955). A.

535.343 : 539.132

1182. VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. XII. m-FLUOROCHLOROBENZENE. F.W.Harris,N.A.Narasimham and J.R.Nielsen.
J. chem. Phys., Vol. 24, No. 6, 1232-5 (June, 1956).

For Pt XI, see Abstr. 4324 (1956). The infrared absorption spectra of gaseous and liquid m-fluorochlorobenzene have been obtained in the region 2-38 μ with NaCl and CsBr prisms. The Raman spectrum of the liquid has been photographed with a 3-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. A complete assignment of the fundamental vibrational frequencies is given, and the spectra are interpreted in detail. A.

535.343 : 539.132

1183. UNCOUPLING EFFECTS IN THE MICROWAVE SPECTRUM OF NITRIC OXIDE. J.J.Gallagher and C.M.Johnson.
Phys. Rev., Vol. 103, No. 6, 1727-37 (Sept. 15, 1956).

The results obtained from the microwave measurements of the rotational spectra of $N^{15}O^{16}$ and $N^{14}O^{16}$ in their $^2\Pi_{1/2}$ ground state are compared by isotopic substitutions and shown to be in excellent agreement. The NO molecule is considered as an intermediate case, slightly removed from Hund's case (a). The theory of spin uncoupling and l uncoupling, developed by Van Vleck and extended by Dousmanis, Sanders and Townes, is applied to the two molecules, and the molecular parameters are calculated accordingly. The resulting rotational constants are B_0 = 49 041.34 Mc/s and D_0 = 0.139 Mc/s for $N^{15}O^{16}$, and B_0 = 50 838.56 Mc/s and D_0 = 0.177 Mc/s for $N^{14}O^{16}$. The Λ-doubling constants are found to have the following values: p_Λ = 170.45 Mc/s for $N^{15}O^{16}$ and 176.15 Mc/s for $N^{14}O^{16}$; and q_Λ = 0.71 Mc/s for $N^{15}O^{16}$ and 1.15 Mc/s for $N^{14}O^{16}$. The magnetic hyperfine structure is treated by an extension of the theory of Frosch and Foley to the intermediate case, and an expression is given for the quadrupole energy in the intermediate case. However, a very slight disagreement still exists between the measured and the calculated hyperfine separations. A complete list of the measured line frequencies is presented along with the calculated values. Also a complete list of all of the molecular and nuclear parameters that have been determined is given. A.

535.343 : 539.132

1184. HYPERFINE STRUCTURE IN THE l-TYPE DOUBLING SPECTRUM OF HCN. L.Yarmus.
Phys. Rev., Vol. 104, No. 2, 365-7 (Oct. 15, 1956).

Direct l-type transitions for HCN have been observed for J = 1,2,3,4 and 5. Values obtained of the asymmetry parameter $\eta = -0.082 \pm 0.005$ and the magnetic coupling constant $c_l = 13 \pm 5$ kc/s are in good agreement with previous work. For N^{14} the value $eq_mQ = -4.81 \pm 0.02$ Mc/s is 5% higher than that obtained in the ground vibrational state. This change in eq_mQ can be explained by a decrease in the hybridization of the σ-bond. A.

535.343

1185. MILLIMETER WAVE SPECTRUM OF FORMALDEHYDE. G.Erlandsson.
J. chem. Phys., Vol. 25, No. 3, 579-80 (Sept., 1956).

The transitions J = 1 → 2 and J = 2 → 3 have been measured at about 2 and 1.3 mm respectively as a check on the rotational constants obtained by Lawrance and Strandberg (Abstr. 7154/1951). Good agreement is reported, the rotation constants being: $B + C = 72\,838.44$ Mc/s, $(B - C)(\vartheta + 0.5\vartheta^2) = 94.90$ Mc/s, $D_J = 0.0826$ Mc/s, and $D_{JK} = 1.311$ Mc/s. G.Allen

535.345 : 537.523.4

1186. THE ABSORPTION OF ULTRAVIOLET IONIZING RADIATION IN GASES. G.R.Bainbridge and W.A.Prowse.
Canad. J. Phys., Vol. 34, No. 10, 1038-45 (Oct., 1956).

The sparking probability of a test gap, to which short-duration direct high voltage pulses are applied, is shown to depend on the distance of the gap from a source of short wavelength ultraviolet radiation. The radiation is restricted to a small volume of gas midway between the electrodes. The sparking probability can therefore be used as a parameter in examining the absorption of the radiation responsible for triggering a discharge in the gas. Absorption of ultraviolet radiation by the gases argon, air, nitrogen and oxygen has been studied. A.

535.345 : 535.39 : 539.23

1187. OPTICAL PROPERTIES OF MAGNESIUM FLUORIDE FILMS. N.Morita.
J. Phys. Soc. Japan, Vol. 11, No. 9, 475-80 (Sept., 1956).

Transmittance and reflectance of magnesium fluoride films deposited on optical glass and fused quartz are measured as functions of wave-length between 3500 A and 6000A. Film deposited on fused quartz kept above 240° C shows remarkable scattering as compared with that of film deposited on optical glass under the same condition. This difference is explained by the affinity of film to substrate surface. Index of refraction is determined from wavelength of transmittance extremes and film-thickness. The ageing effect cannot be observed. The causes of porosity of films are discussed. A.

535.345

1188. THE ABSORPTION SPECTRUM OF SOLID ARSENIC TRISULPHIDE. W.P.Doyle.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 865-6 (Aug., 1956)

Films up to 600 A thick were prepared by evaporation on to quartz disks, and their transmission measured in the wavelength range 0.2-1 μ. The absorption coefficient rises sharply as the wavelength decreases from 0.5 μ, and this is interpreted as the main lattice absorption. Absorption observed in the range 0.5-1 μ is thought to be anomalous. D.G.Avery

535.345 : 551.521.1

ABSORPTION OF SOLAR RADIATION BY SOME MATERIALS. See Abstr. 956

535.36 : 621.326

1189. DIFFUSION OF LIGHT IN FROSTED AND SILICA-COATED INCANDESCENT LAMPS. P.J.Walsh.
J. Opt. Soc. Amer., Vol. 46, No. 7, 558-60 (July, 1956).

Experimental work on the frosted bulb shows that the light distribution can be explained as due to refraction at the elements of the etched surface. In the case of the silica-coated bulb, scattering will explain the distribution adequately if a particle diameter of 0.56 μ is assumed. J.W.T.Walsh

535.36 : 551.593.5

1190. SCATTERING FROM A POINT SOURCE IN PLANE CLOUDS. P.I.Richards.
J. Opt. Soc. Amer., Vol. 46, No. 11, 927-34 (Nov., 1956).

A previously proposed modified form of diffusion theory (Abstr. 923/1956) is applied to problems involving point sources and plane clouds over an absorbing ground. A general but formal solution is first presented. Some analytic results are then obtained for a point source at the edge of a semi-infinite (half-space) cloud; specific formulae are given for the photon density at the edge of the cloud and for the net photon current there; asymptotic results are obtained for large distances inside the cloud along the source axis. Finally, numerical results are presented for the photon density at the mid-plane of an infinite plane cloud with thickness equal to two (transport) mean free paths and a point source at the centre. An appendix summarizes analytic results of the modified theory for: a point source in an infinite medium, a point source at the centre of a finite sphere, the albedo and transmission of an infinite plane slab with parallel ("solar") illumination at an arbitrary angle, the albedo of the combination of a plane cloud over a ground plane with arbitrary albedo, and a rough analysis of ambient light levels in the ocean. A.

535.37

1191. DURATION OF FLUORESCENCE IN THE MESO-DERIVATIVES OF ANTHRACENE. A.S.Cherkasov, V.A.Molchanov, T.M.Vember and K.G.Voldaĭkina.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 292-4 (1956). In Russian.

Presents the results of direct measurements conducted by means of the phase fluorometer described in the paper of Bonch-Bruevich,Molchanov and Shirokov (Izvestiya Akad. Nauk SSSR, Ser. fiz., Vol. 20, No. 5, 1956). The values of the "limiting" duration (for the fluorescence quantum yield = 1), obtained from these results, while widely differing from those calculated by means of Einstein's formula (Physikalische Zeitschrift, Vol. 18, 121, 1917), coincide, for many of the compounds tested, with those calculated from Förster's formula

(Fluoreszenz organischer Verbindungen, Göttingen, 1951, p.158). It was found that the limiting duration of fluorescence is always less for the di-substituted than for the corresponding mono-substituted derivatives. When substituents which lower the fluorescence yield were introduced into the anthracene nucleus, quenching of more than one type was observed. F.Lachman

535.37

1192. LUMINESCENCE IN ZnS : Cu, Cl SINGLE CRYSTALS.
T.B.Tomlinson.
J. Electronics, Vol. 2, No. 3, 293-300 (Nov., 1956).

The impurity responsible for the green and blue bands in "spectrographically pure" single crystals of zinc sulphide is proved to be copper, in conjunction with chlorine. The crystal growth process tends to exclude chlorine so that introduction of copper results in luminescence typical of a low chlorine content, i.e. there is no green-2 band and the electroluminescence is blue at room temperature. The diffusion rate of chlorine is found to be much less than that of copper so that attempts to introduce both copper and chlorine into the crystals were unsuccessful. The provision of copper during crystal growth permits the retention of a greater chlorine content. This gives both the green-2 band and green electroluminescence.

A.

535.37 : 537.312.5

1193. NEGATIVE LUMINESCENCE AND NEGATIVE PHOTOEFFECT. B.I.Stepanov.
Optika i Spektrosk., Vol. 1, No. 2, 125-30 (1956). In Russian.

Theoretical article summarizing results on negative luminescence since 1955. The effect occurs with systems of particles having three energy levels on destruction of equilibrium energy distribution per level. The author also discusses the conditions for a negative photoeffect.

C.R.S.Manders

535.37 : 548.7

1194. THE NATURE OF THE ELEMENTARY OSCILLATORS AND THE POLARIZATION OF THE PHOTOLUMINESCENCE IN CUBIC CRYSTALS. P.P.Feofilov.
Optika i Spektrosk., Vol. 1, No. 2, 131-42 (1956). In Russian.

Theoretical paper on colour centres in fluorides of alkali and alkaline earth metals and on Eu^{+++} ions in the CaF_2 lattice (see also Abstr. 7009-10/1954 and Dokl. Akad. Nauk SSSR, Vol. 99, 731, 1954). It is found that the separate lines in the luminescence spectrum of Eu^{+++} correspond to the radiation of π_e-, σ_e-, π_m- and σ_m- oscillators.

C.R.S.Manders

535.37

1195. HALIDE ACTIVATED HALIDE PHOSPHORS. J.W.Elder.
Proc. Phys. Soc. B, Vol. 69, Pt 9, 934-8 (Sept., 1956).

New absorption peaks have been observed in the long wavelength tail of the fundamental absorption band of pure alkali halides, when a small amount of another alkali halide is added as an impurity. Results are given which suggest that the electronic levels involved in the optical process are associated with the activator ion and that the mechanism may be described by a configurational coordinate model.

A.

535.37

1196. MEASUREMENT OF THE ABSOLUTE QUANTUM YIELD OF PHOTOLUMINESCENCE OF ALKALI HALIDE CRYSTALS.
Z.L.Morgenshtern.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 903-4 (1955). In Russian.
English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 773-4 (July, 1956).

The absolute quantum yield has been measured for ultra-violet excitation of Tl-activated KCl, KI and NaI by wavelengths between 2460 and 2930 A. The crystals were irradiated in a small integrating sphere lined with a "light yellow phosphor" which had a quantum efficiency independent of the wavelength of exciting radiation between 2400 and 5000 A. Measurements were made of the incident ultra-violet, the reflected part, and the fluorescence. The quantum efficiency for KCl and KI varied between 0.70 and 0.93; for NaI between 0.40 and 0.61. Some organic crystals excited by 2500 A gave values between 0.57 (tolane) and 0.18 (naphthalene). S.T.Henderson

535.37

1197. INFLUENCE OF ABSORPTION OF LUMINESCENCE ON INTENSITY OF EMISSION IN POWDER PHOSPHORS.
A.P.Ivanov.
Zh. éksper. teor. Fiz., Vol. 30, No. 1, 196-7 (1956). In Russian.

The dependence of the intensity of luminescence of powders on the grain size relative to the refractive index and the absorption coefficients was previously established (Abstr. 10066/1954). In the previous treatment the absorption of the luminescent emission in the powder was neglected. This is now considered in a new theoretical treatment and more general formulae are developed and are applied to particular cases. J.Ewles

535.37

1198. PROPERTIES OF SCINTILLATION PLASTIC MATERIALS.
M.M.Koton.
Zh. tekh. Fiz., Vol. 26, No. 8, 1741-3 (1956). In Russian.

Results of studies on different polymers and copolymers showed that, by introducing spectrally purified anthracene (or other aromatic or heterocyclic hydrocarbons) into different monomers (styrene and its derivatives, esters of methacrylic acid, naphthalene derivatives) and polymerizing them subsequently in the presence of benzoyl peroxide, one obtains plastic materials whose activity is closely related to the chemical structure of monomer used. It was found that best results were obtained with polystyrene (with or without naphthalene derivatives) as plastic material, the organic scintillators used containing not less than three nuclei with conjugated double bonds (e.g., anthracene or its derivatives, or terphenyl). F.Lachman

535.371

1199. MEASUREMENT OF LOW FLUORESCENCE INTENSITIES.
A.Dammers-de Klerk and F.J.Spruit.
J. Opt. Soc. Amer., Vol. 46, No. 7, 556 (July, 1956).

535.371 : 535.5

1200. PHOTOELECTRIC METHOD FOR THE MEASUREMENT OF THE POLARIZATION OF THE FLUORESCENCE OF SOLUTIONS.
G.Weber.
J. Opt. Soc. Amer., Vol. 46, No. 11, 962-70 (Nov., 1956).

A photoelectric polarization photometer is described for the measurement of the polarization of the fluorescence of solutions. This instrument uses the principle that the linearly polarized component of the fluorescence vibrating in the direction of propagation of the exciting light is independent of the plane of polarization of the excitation and may be used to give a reference signal against which the signal given by the fluorescence component in the direction of vibration of the excitation may be compared. Positive and negative polarizations may be measured and actual measurements of solutions with $p = 0.003$ to $p = 0.44$ show the standard deviation of a measurement to be $\Delta p = \pm 0.001$. Analysis of the systematic errors involved indicates an absolute precision of equal magnitude. The absorption and re-emission of the fluorescence by the solutions results in changes of the polarization with concentration which are easily detected in the case of glycerol and water solutions of xanthydrol derivatives, where conditions are particularly favourable. A.

535.372

1201. PHOSPHORESCENCE SPECTRA OF SOME AROMATIC ACIDS AT THE TEMPERATURE OF LIQUID AIR. B.A.Pyatnitskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 503-6 (1956). In Russian.

Presents result of investigations of the phosphorescence spectra of alcoholic solutions of benzoic (a), phthalic (b) and gallic (c) acids, carried out by means of a glass spectrograph. Eight bands with maxima between 4047 and 5431 A have been found for (a), five bands (4034-5837 A) for (b), and 10 bands (4276-6293 A) for (c). At the temperature of liquid air these spectra have vibrational structure, two vibration frequencies (313 and 608 cm^{-1}, corresponding to C—H and benzene-ring C—H bond, respectively) appearing in each spectrum. A formula is developed for determining the frequency of band maxima. F.Lachman

535.372

1202. FLUORESCENCE SPECTRUM OF Pu^{+3} IN $LaCl_3$.
B.B.Cunningham, D.M.Gruen, J.G.Conway and R.D.McLaughlin.
J. chem. Phys., Vol. 24, No. 6, 1275 (June, 1956).

A crystal of $LaCl_3$ containing 0.1% Pu fluoresces spontaneously because of the radioactivity of Pu^{239}. Wavelengths and approximate intensities of 25 fluorescent lines in the visible are listed.

G.F.Lothian

535.372

1203. MULTIBAND LUMINESCENCE IN BORON NITRIDE.
S.Larach and R.E.Shrader.
Phys. Rev., Vol. 104, No. 1, 68-73 (Oct. 1, 1956).

Boron nitride can be excited to luminesce by (1) alternating electric fields, (2) ultraviolet photons, or (3) cathode rays. The luminescence, in all cases, has a complex emission spectrum, extending from approximately 2950 A to 6500 A. The relative intens-

ities of the bands in the fine structure are affected by current density with cathode-ray excitation, and by the energy (frequency) of the photons with ultraviolet excitation. The maximum of the photoluminescence emission intensity with temperature occurs at about 875°K, with the luminescence emission intensity falling to 50% of the maximum value at approximately 1375°K. Correspondence of known infrared absorption bands with energy differences in the fine structure in the luminescence suggest vibrational origins for the fine structure. The identities of the excited electronic states have not yet been ascertained, although these may be due to exciton states, impurity states, or surface states. A.

535.375.5

1204. THE COMBINATION SCATTERING [RAMAN] SPECTRA OF LOW MOLECULAR POLYSILOXANES. Ya.M. Slobodin, Ya.É.Shmulyakovskiĭ and K.A.Rzhendzinskaya.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 958-60 (1955). In Russian.

The Raman frequencies of $CH_3[(CH_3)_2SiO]_mSi(CH_3)_3$ with m = 2, 3 and 4 and of $[Si(CH_3)_2O]_n$ = 3, 4, 5 and 6 are given. The frequencies are briefly discussed and assigned in part: 2960, 2900, 1409 and 690 cm^{-1} to Si—CH_3 structures; 795 cm^{-1} specifically to $Si(CH_3)_2$; 840 and 750 cm^{-1} specifically to $Si(CH_3)_3$ and 867 cm^{-1} to the cyclic molecules. D.H.Whiffen

535.375.5

1205. INTENSITIES IN RAMAN SPECTRA. III. A PHOTOELECTRIC RECORDING RAMAN SPECTROMETER FOR INTENSITY MEASUREMENTS. D.A.Long, D.C.Milner and A.G.Thomas.
Proc. Roy. Soc. A, Vol. 236, 186-96 (Oct. 9, 1956).

For Pt II, see Abstr. 4408 (1954). A description is given of a Raman apparatus designed primarily for intensity measurements by direct photoelectric recording. A special feature is a high-intensity light source with four Toronto-type mercury arcs. It is possible to use a variety of sample volumes and to make measurements on samples over a wide range of temperatures both above and below room temperature. Semi-quantitative polarization measurements can also be made. The recording system uses an eleven-stage photomultiplier cell with a.c. amplification at 285 c/s, followed by rectification in a phase-sensitive homodyne circuit. The output is fed to a recording potentiometer. Details of calibration for intensity measurements are given and sample records are shown illustrating the various applications of the apparatus. A.

535.375.5 : 539.132

1206. INTENSITIES IN RAMAN SPECTRA. IV. INTENSITY MEASUREMENTS FOR SOME CHLOROMETHANES. D.A.Long, D.C.Milner and A.G.Thomas.
Proc. Roy. Soc. A, Vol. 236, 197-211 (Oct. 9, 1956).

The calculation of derivations of the invariants of the molecular polarizabilities from experimentally measured Raman intensities is critically discussed. Intensity formulae developed in Pt I are reviewed and a simplification introduced. Intensity measurements for the compounds CCl_4, $CHCl_3$ and CH_2Cl_2 are tabulated and discussed in relation to a bond polarizability theory. A modification of the simple theory is investigated. A.

535.375.5

1207. PHOTOELECTRIC RECORDING OF SPECTRA OF COMBINATION [RAMAN] SCATTERING OF POWDERY MATERIALS. Ya.S.Babovich and V.M.Pivovarov.
Zh. éksper. teor. Fiz., Vol. 29, No. 5 (11), 696-7 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 574-6 (May, 1956).

Describes photoelectric recording of the appropriate spectra. The latter were excited by a low pressure Hg lamp, practically free from continuous background. Details of the lamp are given and two spectra (for naphthalene and para-nitrotoluene) are shown. J.D.Craggs

535.376

1208. ELECTROLUMINESCENCE IN ZINC SULPHIDE.
J.F.Waymouth and F.Bitter.
Phys. Rev., Vol. 103, No. 5, 1584-5 (Sept. 1, 1956).

Objections are advanced to Thornton's assumptions (Abstr. 3645/1956) that (1) the density of ionized luminescent centres is too small to disturb the potential distribution established by thermally ionized co-activators, and (2) the shape of the brightness wave is entirely dependent on detrapping of electrons from various depths. The authors' earlier results on light emission from discrete spots in the crystal are quoted. S.T.Henderson

535.376

1209. ELECTROLUMINESCENCE IN ZINC SULPHIDE.
W.A.Thornton.
Phys. Rev., Vol. 103, No. 5, 1585-6 (Sept. 1, 1956).

A reply to Waymouth and Bitter (preceding abstract), elaborating arguments in favour of Thornton's original views. A diagram is given for the unsymmetrical light output from a single crystallite during a voltage cycle. S.T.Henderson

535.376

1210. PHOSPHORESCENCE OF THE CRYSTAL PHOSPHOR ZnS(Cu) DURING EXCITATION BY AN ELECTRON BEAM.
T.P.Belikova.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 905-6 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 776-7 (July, 1956).

A comparison of the decay excited by 2 kV electrons and by 3650 A radiation. Both give hyperbolic decays after long times, with smaller slopes for electron excitation, though the excitation density is much higher in this case for equal phosphor brightness. Glow curves are very similar for the two kinds of excitation and so do not explain the differences in decay. S.T.Henderson

535.393 : 539.234

1211. VARIATION WITH WAVELENGTH OF THE PHASE CHANGE ON REFLECTION OF LIGHT IN AIR BY A THIN EVAPORATED LAYER OF SILVER. R.Philip.
C.R. Acad. Sci. (Paris), Vol. 243, No. 4, 365-6 (July 23, 1956). In French.

A graph is given of the variation of the phase change on reflection from an evaporated film of Ag, 202 A thick, for wavelengths between 2200 and 6438 A. The phase change is determined from measurements of the diameter of the fringes in a Fabry—Pérot interferometer of which one plate carries the film under examination. D.G.Avery

535.417 : 531.715.1

1212. AN OPTICAL DILATOMETER. J.Terpstra.
Appl. sci. Res. B, Vol. 4, No. 6, 434-46 (1955).

An instrument is described which enables displacements of 2×10^{-5} cm to be determined by means of interference phenomena of monochromatic light. The measuring pin is pushed against the specimen with a force of 4000 dynes. The instrument setting remains stable for a period of several hours. A.

535.417 : 531.717 : 535.323

1213. STEPPED INTERFERENCE REFLECTOR FOR DETERMINING THE OPTICAL CONSTANTS OF NONABSORBING UNIMOLECULAR FILMS. II. EXPERIMENTAL. R.D.Mattuck, R.D.Petti and J.B.Bateman.
J. Opt. Soc. Amer., Vol.46, No. 10, 782-9 (Oct., 1956).

For Pt I see Abstr. 7318 (1956). The validity of the stepped interference reflector method is tested over the range of refractive indices 1.25 to 2.0, and film thickness 10 A to 250 A. It is shown by comparison of results with those obtained by independent means (Abelès) that the method works well in the above thickness range, and for indices between 1.4 and 1.7, but needs additional testing outside these limits. The apparatus and procedures are described and the results of measurements of three different types of films, (transferred, evaporated, and adsorbed) involving 9 different substances are reported. The procedures are simple, and measurements and calculations of index and thickness of an unknown film may be completed in 1 hr. A.

535.42 : 538.566

1214. ON THE CROSS-SECTION THEOREM FOR ELECTROMAGNETIC WAVES. G.Toraldo di Francia.
Atti Fond. Ronchi, Vol. 11, No. 3, 243-9 (May-June, 1956). In Italian.

A rigorous proof is given of the relation existing between the forward scattering amplitude and the total cross-section for an electromagnetic wave incident on a body of general properties. A.

535.43

1215. ANOMALOUS SCATTERING OF LIGHT IN GLASS.
A.I.Kolyadin.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 1, 64-7 (1956). In Russian.

Indices of the scattering of light of various wavelengths have been determined for sodium-borosilicate glass specimens whose opalescence varied within very wide (over 1000/1) limits. A beam of polarized light was made to pass centrally through the specimen which had a form of a spherical layer; the relative (and reduced)

luminosity of scattered light was determined by means of a visual photometer for various scattering angles φ, and was extrapolated for angles 0 and 180°. In all experiments, by far the greater part of energy was scattered into the back hemisphere. When the primary beam was polarized in the plane of scattering, the indices rose steadily from 0 to 180°; when it was polarized at right angles to the plane of scattering, the indices passed through a minimum at $\varphi = 90°$. It was found that, like in Rayleigh's formula, the scattering function in the glass employed could be expressed as a product of a term containing the wavelength and all the parameters of the medium by an angle factor; hence, in a given specimen, the scatter curves for different wavelengths can be reduced to a single curve if their ordinates are multiplied by certain factors independent of the angle. The asymmetry of indices, and the angle of maximum polarization, disagree with the classical (non-Raman) theory of the scattering of light. A theory is proposed, based on the interference of vibrations emitted by two dipoles whose distance is small compared with λ; they are arranged along the primary beam and vibrate, with equal amplitudes and a certain phase difference, at right angles to the primary beam. The emission intensity curves obtained can be made identical with the experimental ones. It appears that, in this glass, the scattering particles behave like quadrupoles rather than dipoles. F.Lachman

535.43 : 538.566 : 534.26

ON THE SCATTERING OF SPHERICAL WAVES BY A CYLINDRICAL OBJECT. See Abstr. 1146

535.55 : 538.612

1216. A THEORY OF MAGNETIC DOUBLE REFRACTION. A.D.Buckingham and J.A.Pople.
Proc. Phys. Soc. B, Vol. 69, Pt 11, 1133-8 (Nov., 1956).

A theory of the birefringence produced in a substance perpendicular to a strong magnetic field (the Cotton–Mouton effect) is presented. Allowance is made for electrical anisotropy induced directly by the magnetic field, an effect which can occur even for isotropic molecules. The effect of molecular interaction on measurements in dense gases and liquids is also considered. A.

535.58 : 539.132

1217. ANOMALOUS DISPERSION OF LIGHT IN DYE SOLUTIONS. I.S.Gorban' and A.A.Shishlovskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 210-13 (1956).' In Russian.

An investigation is made of the applicability of Davȳdov's theory to the case of solutions with complex structure of the absorbing centres, where the intramolecular electronic excitations are accompanied by changes in the vibrational state both of the absorbing molecule and the surroundings. Thin solutions of mono-nuclear dyes were examined. Within the absorption region the dispersion curves are symmetrical, not in accord with Davȳdov's first approximation. The mean values of oscillator forces agree with those from other measurements. For high concentrations the dispersion curve approximates to a Gaussian one. J.Jacobs

535.64

1218. ON PROJECTIVE TRANSFORMATIONS OF THE CIE-CHROMATICITY DIAGRAM. G.Wyszecki.
J. Opt. Soc. Amer., Vol. 46, No. 11, 982-6 (Nov., 1956).

A classification of projective transformations of the plane with respect to their fixed elements is introduced into the whole universe of projective transformations of the CIE chromaticity diagram. On the basis of the given classification and by using some theorems of projective geometry a graphical method is developed for constructing chromaticity coordinates x',y' which correspond to given chromaticity coordinates x,y by a given transformation matrix. The principle of the graphical method holds for all types of projective transformations. In connection with some examples which demonstrate the theory, the intrinsic significance of the fixed points of a projective transformation is discussed with respect to colorimetric problems. A.

535.8 : 535.56

1219. A PHOTOELECTRIC ARRANGEMENT FOR POLARIMETRIC MEASUREMENTS. R.Birebent.
C.R. Acad. Sci. (Paris), Vol. 243, No. 6,578-80 (Aug. 6, 1956). In French.

Light transmitted through a polarimeter fitted with a half-shadow device is focused on the cathode of a photomultiplier connected to a galvanometer. Light, first from one half of the field, and then from the other is used and the polarimeter adjusted until the galvanometer deflection is the same for both cases. H.G.Jerrard

535.81

1220. ALLOWANCE FOR MULTIPLE REFLECTIONS IN TECHNICAL OPTICS CALCULATIONS. L.M.Biberman.
Svetotekhnika, 1956, No. 5, 1-4. In Russian.

Establishes the connection between the method of allowing for multiple reflections by solving an integral equation (J. Opt. Soc. Amer., Vol. 30, 195-205, May, 1940) and the following approximate methods of calculating fluxes with multiple reflections: the method of successive approximations, and the substitution of a system of linear algebraic equations for the integral equation. It is claimed that the relationships obtained can be found useful in technical optics calculations. F.Lachman

HEAT 536

536.212

1221. THERMAL CONDUCTIVITY OF SOME DILUTE SILVER ALLOYS. A.N.Gerritsen and J.O.Linde.
Physica, Vol. 22, No. 9, 821-31 (Sept., 1956).

The results of heat conductivity measurements at liquid air and liquid hydrogen temperatures on alloys of silver with small amounts of manganese, indium and lead are discussed as a preliminary to further investigations at temperatures below 14°K. The thermal resistivity is not linear with the concentration of solute metal, but increases faster than proportional to c for small concentrations (below 0.2 at. %). This effect is strongest for lead. A.

536.22 : 536.75 : 532.5.032

HEAT CONDUCTION IN A MOVING VISCOUS FLUID. See Abstr. 1101

536.37 : 541.11

1222. ON WIDENING OF THE COKE CHANNEL DURING TREATMENT OF COAL BY ELECTRIC CURRENT. G.I.Barenblatt.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 239-42 (1956). In Russian.

A mathematical treatment of the temperature distribution around a cylindrical conducting coke channel in coal. J.M.Hough

536.413

1223. THERMAL EXPANSION OF CAESIUM BROMIDE. R.S.Krishnan and R.Srinivasan.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 679-82 (June, 1956).

The expansion coefficient has been determined from −139° to 300° C by an interferometric method using a synthetic single crystal. The results are found to differ by some 20% from those by an X-ray method of Johnson, Agron and Bredig (Abstr. 7422/1955). F.E.Hoare

536.421.1

1224. MELTING POINTS OF ZINC, CADMIUM, THALLIUM AND ANTIMONY AT PRESSURES UP TO 30 000 kg/cm². V.P.Butuzov, E.G.Ponyatovskiĭ and G.P.Shakhovskoĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 519-20 (1956). In Russian.

Between near-zero pressures and 3×10^4 atm the melting point of zinc increases by 120°, the melting points of cadmium and thallium increase by 190° and the melting point of antimony decreases by 45° C approximately. The melting curves with positive slopes are fairly rectilinear. The exceptional behaviour of antimony is interpreted as an indication for a hypothetical transition point, to be located near 550°C and 4×10^4 atm. R.Eisenschitz

536.421.4

1225. THE FREEZING OF WATER DROPLETS. A.E.Carte.
Proc. Phys. Soc. B, Vol. 69, Pt 10, 1028-37 (Oct., 1956).

A microscope method was used to study the freezing of individual water droplets 9 to 33 microns in diameter formed by condensation on various surfaces and protected with a film of silicone oil. The lowest freezing temperatures were found to be independent of the six surfaces used but dependent upon the volume of the water droplets and the rate of cooling. The results were correlated with those of other observers and it was concluded that homogeneous nucleation occurred in the lowest freezing droplets. Values of the surface free energy for a water–ice interface were calculated. A.

536.423

1226. THE MECHANISM OF EVAPORATION. O.Knacke and I.N.Stranski.
Progress in metal physics, Volume 6, 181-235. See Abstr. 7097 (1956).

A review. Discusses experimental methods for determining the condensation coefficient, using either evaporation into a high vacuum, at higher pressures or condensation. The theory of evaporation is discussed, including consideration of statistical calculations, the mechanism of step-wise evaporation and application of transition-state theory. 100 references. E.P.Wohlfarth

536.423.1

1227. EVAPORATION OF DROPS OF COMBUSTIBLE LIQUIDS. V.A.Fedoseev and D.I.Polishchuk.
Zh. tekh. Fiz., Vol. 26, No. 7, 1509-18 (1956). In Russian.

Evaporating liquid drops are observed under the microscope and the rate of change of their diameter is converted to the rate of vaporization. Experiments are made with drops of benzene, toluene, xylene and alcohol surrounded by an atmosphere of air which is flowing at a steady rate or is at rest; in the latter case some vapour of the vaporizing substance is admixed to the atmosphere. Results corresponding to various temperatures, rates of flow and concentrations of vapour are shown in the form of graphs and tables. R.Eisenschitz

536.423.1 : 539.172.4

EFFECT OF REACTOR FLUX ON BOILING WATER. See Abstr. 1637

536.423.4 : 536.483

1228. ON THE PROBLEM OF FINDING THE OPTIMUM WORKING CONDITIONS FOR A HELIUM LIQUEFIER. I.B.Danilov.
Zh. tekh. Fiz., Vol. 26, No. 5, 1045-7 (1956). In Russian.

For a liquefier depending on Joule–Kelvin expansion and using liquid hydrogen for pre-cooling, the best yield would be expected from the thermodynamical state diagrams, at a working pressure of 32-35 atm. Experience shows that a pressure of about 26 atm is preferable. This divergence is resolved by investigating conditions in the heat exchanger; it is found that losses of cold increase with increasing pressure. R.Eisenschitz

536.423.4

1229. CONDENSATION OF A MIXTURE OF VAPOURS UNDER INTENSE COOLING. G.P.Golovinskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 6, 1309-28 (1956). In Russian.

Discussion of results obtained in studies on liquid air. Topics dealt with are: (1) measurement of low temperatures and the determination of the saturation temperature of the condensing vapours, (2) determination of the magnitude of the heat in flow through the lagging and metal parts. Photographs of droplet condensation (1.5 atm), an intermediate regime (2 atm) and simple film type condensation (3-6 atm), and a table of the heat transfer coefficients for the condensing vapours of N_2, O_2 and A are included. C.R.S.Manders

536.46 : 535.333

1230. SPECTROSCOPIC OBSERVATIONS ON PENTABORANE–AIR FLAMES AND EXPLOSIONS. W.G.Berl, E.L.Gayhart, H.L. Olsen, H.P.Broida and K.E.Shuler.
J. chem. Phys., Vol. 25, No. 4, 797 (Oct., 1956).

The diffusion flame of B_5H_9 with N_2 in air shows the α-bands of BO and the diffuse fluctuation bands of B_2O_3. The explosion flame of B_5H_9 premixed with air shows only the B_2O_3. The diffusion flame has a temperature of only 500°C and emission by BO and B_2O_3 is probably chemiluminescent. A.G.Gaydon

536.461

1231. STABILITY OF THE FLAME FRONT DURING THE SLOW BURNING OF LIQUIDS. V.G.Levich.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 5, 975-8 (1956). In Russian.

It is shown theoretically, starting from the Navier–Stokes equations and the continuity equation for both liquids (the burnt and the unburnt one), that the conditions of stable combustion are expressed by the inequality $j^3 < 3\sqrt{3}\, g\, \nu_1 \rho_1^{3/2} \rho_2^{3/2}$, where j is the flux of the liquid (on either side of the discontinuity surface), ν_1 is the kinematic viscosity of the unburnt liquid, and ρ_1 and ρ_2 are the densities of the unburnt and burnt liquid, respectively. If the viscosity of the burning liquid is of the order of 1 poise, the stabilizing factor is viscosity rather than surface tension. F.Lachman

536.48 : 532.13

VISCOSITY OF LIQUID NITROGEN. See Abstr. 1098

536.48

1232. THE SPECIFIC HEAT AND ENTROPY OF LIQUID HELIUM THREE. S.M.Bhagat.
Proc. Phys. Soc. B, Vol. 69, Pt 11, 1117-23 (Nov., 1956).

An "imperfect gas" model for liquid He^3 has been developed. It appears that the observed specific heat and entropy of liquid He^3 can be explained, with good accuracy, by treating the liquid as an "imperfect gas" with a number density some four times less than the actual number density of liquid He^3. Incidentally, one may also, at least qualitatively, account for the low degeneracy temperature expected from magnetic susceptibility measurements. A.

536.48

1233. IRON CATALYST FOR PRODUCTION OF LIQUID PARA-HYDROGEN. D.H.Weitzel and O.E.Park.
Rev. sci. Instrum., Vol. 27, No. 1, 57-8 (Jan., 1956).

536.48 : 541.183

1234. FIRST ADSORBED LAYER OF HELIUM. L.Meyer.
Phys. Rev., Vol. 103, No. 6, 1593-6 (Sept. 15, 1956).

The discrepancy between the force constants for the adsorption of helium found by Bowers at high saturations using the Frenkel isotherm, and Strauss at medium saturations using the Brunauer–Emmet–Teller theory creates some doubts whether or not the amount v_m derived from the BET isotherm in the saturation range $P/P_0 = 0.02$-0.2 represents in the case of helium the amount adsorbed in the first layer. Adsorption measurements at very low saturations show a distinct plateau in the 2°K isotherm at $P/P_0 \sim 10^{-7}$ for ~ 0.5 cm^3/m^2 adsorbed suggesting the completion of the first layer already at these low saturations. At 4.2°K this plateau coalesces with the usual point B of sigmoid isotherms, where ~ 0.8 cm^3/m^2 = v_m is adsorbed. It is therefore proposed to interpret v_m as the amount adsorbed with $(\overline{E}_a - E_0) > RT$ ($\overline{E}_a$ being the differential energy of adsorption, E_0 the energy of vaporization of the bulk liquid), which coincides with the completion of the first layer only for $(E_1 - E_0)$ between about 2RT and 8RT. A.

536.48

1235. NEW EVIDENCE ABOUT THE NATURE OF THE LIQUID HELIUM TRANSITION. H.N.V. Temperley.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 630-4 (Aug., 1956).

The temperature dependence of the kinetic and potential energy of liquid He which has been calculated from X-ray data by Goldstein and Reekie (Abstr. 5929/1955, 1170/1956) is discussed in the light of the author's theory of liquid helium (Abstr. 1244/1954). He II is considered as an equilibrium state between large and small aggregates. The latter begin to form at the λ-point and approach to a constant percentage at low temperatures. It is assumed that the small aggregates have only one bound level but also some translational energy as a whole. This has been related to the negative expansion coefficient and the associated anomaly of the potential energy. H.London

536.48

1236. AMPLITUDE DEPENDENCE OF THE VELOCITY OF SECOND SOUND. A.J.Dessler and W.M.Fairbank.
Phys. Rev., Vol. 104, No. 1, 6-10 (Oct. 1, 1956).

The amplitude dependence of the velocity of second sound in liquid helium was measured as a function of temperature between 0.936°K and 2.045°K. The results are in agreement with the theoretical predications of Temperley and Khalatnikov. The possibility that amplitude effects are the cause of the discrepancies in the various published values of the velocity of second sound is discussed. An explanation is offered for the anomalous dependence, observed by Osborne, of the velocity of large amplitude signals on the distance between the heater and the bolometer. A.

536.521

1237. INFLUENCE OF HUMIDITY ON MEASUREMENTS WITH RADIATION PYROMETERS. R.Smit.
Appl. sci. Res. B, Vol. 5, No. 6, 428-36 (1956).

Calculations are given for determining the errors, caused by water vapour absorption, in temperature measurements with radiation pyrometers of different optical systems. Some experimental checks are included. A.

536.55 : 537.523.5

CARBON ARC TEMPERATURE MEASUREMENT. See Abstr. 1335

536.62

1238. HEAT OF WATER VAPORIZATION AS A CHEMICAL CALIBRATION STANDARD FOR SOLUTION CALORIMETRY. J.D.Ray.
Rev. sci. Instrum., Vol. 27, No. 10, 863-4 (Oct., 1956).

A simple method for calibration of calorimeters used in solution calorimetry has been devised. The heat of vaporization of water is taken as a chemical standard for this process and shown to be unaffected by the speed and pressure employed in pumping it out of the evaporator described. A.

536.655

1239. HEAT OF VAPORIZATION OF OXYGEN IN THE TEMPERATURE RANGE 80-106°K. R.A.Alikhanov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 902-3 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 771-3 (July, 1956).

The experimental technique is briefly described and the results compared with experimental and theoretical values obtained by other workers. The value obtained for the heat of vaporization at 90.19°K (the normal boiling point) is 1628.7 ± 1.3 cal/mole. H.C.Cole

THERMODYNAMICS 536.7/.8

536.7 : 530.162

PHENOMENOLOGICAL THEORY OF STATISTICAL THERMODYNAMICS. See Abstr. 1082

536.71

1240. EQUATION OF STATE OF SOLIDS. R.S.Sharma.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 838-40 (Aug., 1956).

Continuation of Abstr. 1411 (1956). The Grüneisen theory for solid Na and Li is tested by comparing values of $\gamma E_{vib}/V$ (derived from experiments) with values of $\partial U_{lattice}/\partial V$ calculated from formulae due to Fürth. R.O.Davies

536.71

1241. THE REDUCED EQUATION OF STATE.
J.S.Rowlinson.
Trans Faraday Soc., Vol. 51, Pt 10, 1317-26 (Oct., 1955).

A table is given of the compressibility factor, pV/RT, of the inert gases as a function of the reduced temperature and the reduced density. It is shown that this table may be used to calculate the compressibility factor of substances which obey different reduced equations of state when the difference is due to the non-spherical shape of their molecules. The method is applicable to any substance whose vapour pressure is known up to the critical point and which is not strongly polar. The accuracy is generally about 1% at densities near the critical. A.

536.73

1242. FURTHER REMARKS ABOUT THE APPLICABILITY OF THE SECOND LAW OF THERMODYNAMICS TO LARGE VOLUMES OF A GRAVITATING GAS. M.I.Shakhparonov.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1144-5 (1956). In Russian.

Recent assertions by Terletskiĭ (Abstr. 7878/1952, 6296/1956) that the second law of thermodynamics does not apply to large volumes of a gravitating gas are proved incorrect; they are a priori false because the proof given by Terletskiĭ is based on statistical thermodynamics, which is simply a statistical interpretation of the second law. R.C.Murray

ELECTRICITY 537

537.123 : 539.18

1243. SELECTION RULES FOR THE ANNIHILATION OF ANTIPROTONS GOING INTO π-MESONS. L.M.Afrikyan.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 136-8 (1956). In Russian.

Rules from conservation of angular momentum, space and charge parity are written down, e.g., the singlet S-state cannot decay into an even number of π-mesons. G.E.Brown

ELECTROSTATICS. DIELECTRICS 537.2

537.212

1244. LIMIT ANGLES IN THE ELECTROSTATIC FIELD OF TWO SPHERES BEARING CHARGES OF OPPOSITE POLARITY.
B.Konorski.
Arch. elektrotech. (Warsaw), Vol. 5, No. 2, 211-49 (1956). In Polish.

On the sphere bearing larger charge a circle determines the limit between field lines ending at the other sphere and those going to infinity. The solid angle corresponding to the circle is calculated first for a simple case of a point and a sphere, then equations for the general case are established and applied to numerical examples. A.Karlsbad

537.213 : 621.317.32

1245. A PHOTOELECTRIC RELAY FOR MEASURING VOLTAGES OF LOW FREQUENCY. J.M.W.Milatz, H.J.J. van Boort, J. van Laar and C.T.J. Alkemade.
Appl. sci. Res. B, Vol. 4, No. 6, 447-56 (1955).

A device is described, which can be used for amplifying and measuring the a.c. output of slow responding detectors (e.g. bolometers), receiving signals of constant but low frequency (~ 1 c/s). This device, based on frequency conversion, which in principle is insensitive to drift-effects, consists of a primary galvanometer, a rotating disk, chopping the light beam reflected by the moving mirror of this galvanometer, and a phototube which receives the chopped light beam and which is coupled to an a.c. amplifier with an a.c. galvanometer as indicating instrument. The sensitivity of the instrument described, which has a response frequency of $1\frac{2}{3}$ c/s, proved to be limited by the Johnson noise of the input circuit only; drift effects proved to be greatly reduced. A.

537.213

1246. A METHOD FOR THE MEASUREMENT OF SURFACE POTENTIALS AND ITS APPLICATIONS. F.Falco.
Ricerca sci., Vol. 26, No. 7, 2111-17 (July, 1956). In Italian.

Describes a method for the measurement of changes in phase boundary electrical potentials liquid–air and solid–air. The method is based on the amplification of the Volta effect in a condenser with an an electrometic voltmeter. There are also plotted the data concerning the measurements performed on metallic surfaces and aqueous solutions containing different percentages of organic compounds. A.

537.222

1247. ELECTROSTATIC CHARGE SEPARATION AT METAL–INSULATOR CONTACTS. P.E.Wagner.
J. appl. Phys., Vol. 27, No. 11, 1300-10 (Nov., 1956).

An investigation has been made of the electrostatic charge produced in vacuum on several inorganic insulators when they are put into rolling contact with nickel, platinum and copper surfaces. The primary role of relative motion is to increase the area on the insulator that ultimately undergoes contact, thereby increasing the total charge separated. With quartz, all evidence favours electron transfer which occurs because the nonconductor has a higher effective work function than the metal. Field emission-induced back leakage of electrons during separation of the charged surfaces is considered to reduce the charge originally separated to that actually measured. Little difference is seen between the charging properties of quartz cleaned chemically in room air and quartz subsequently outgassed at 700°C in vacuo better than 10^{-8} mm Hg. No difference in electron affinity is found between fused and monocrystalline quartz. No evidence directly supporting electron transfer is found for the other insulators tested, synthetic single crystals of Al_2O_3, MgO, NaCl, KCl, KBr and KI; and the possibility of ion transfer is considered. All charge against nickel much less vigorously and less reproducibly than does quartz. The alkali halides and MgO which contains excess Mg or O as a bulk impurity charge positively, while stoichiometric MgO charges negatively. With Al_2O_3, there is a strong dependence of charge density on crystallographic orientation. Alteration of charging properties by surface and/or bulk conduction is found to be negligible for all insulators tested, within the reproducibility of the charging measurements. A.

537.222

1248. GROWING ELECTRIC SPACE-CHARGE WAVES.
J.R.Pierce and L.R.Walker.
Phys. Rev., Vol. 104, No. 2, 306-7 (Oct. 15, 1956).

Some familiar aspects of the theory of growing space-charge waves are restated as a comment on recent criticism of this theory by J.H.Piddington. A.

537.222

1249. THE DISPERSAL OF AGGREGATIONS OF SPACE CHARGE. O.P. Beguchev.
Zh. tekh. Fiz., Vol. 26, No. 7, 1483-6 (1956). In Russian.

Theoretical paper. Starting with the equation of conservation of charge, the equations of motion are developed and thence the distribution of density in a dispersing relativistic aggregation. The cases of dispersal in spherical and axial symmetrical aggregations are discussed and their solution only appears possible in numerical form. The effect of thermal scatter of velocities on the dispersal of an aggregation is also examined. C.R.S.Manders

537.226

1250. LIMIT-PERIODIC DIELECTRIC MEDIA. R.Redheffer.
J. appl. Phys., Vol. 27, No. 10, 1136-40 (Oct., 1956).

A stratified dielectric sheet with dielectric constant $\epsilon(x)$, permeability $\mu(x)$ and thickness d is uniformly contracted to yield a sheet with parameters $\epsilon(nx)$, $\mu(nx)$, d/n. Now n of these contracted panels are stacked up to yield again a sheet of thickness d. What can be said of the limiting medium obtained in this way, as $n \to \infty$? If the symbol [ ] denotes "mean value of", the results of this paper may be summarized as follows: At perpendicular polarization, the limiting medium acts like a homogeneous medium with dielectric constant, permeability and thickness given respectively by $[\epsilon][\mu]^{-1/2}[1/\mu]^{-1/2}$, $[\mu]^{1/2}[1/\mu]^{-1/2}$, $d[\mu]^{1/2}[1/\mu]^{1/2}$. At parallel polarization the parameters are, respectively, $[\epsilon]^{1/2}[1/\epsilon]^{-1/2}$, $[\mu][\epsilon]^{-1/2}[1/\epsilon]^{-1/2}$, $d[\epsilon]^{1/2}[1/\epsilon]^{1/2}$. The relevance of these results to topics of current interest is indicated. The analysis is not based on the equivalent-circuit analogues which are sometimes used to study artificial dielectrics, but is developed without approximation from Maxwell's equations. A.

537.226.1 : 541.135

1251. DEBYE–HÜCKEL THEORY AND THE CONCENTRATION DEPENDENT DIELECTRIC CONSTANT. S.Teitler and N.Ginsburg.
J. chem. Phys., Vol. 25, No. 4, 783-4 (Oct., 1956).

Assuming that this dielectric constant is the one involved in the interaction between ions an expression for the mean stoichiometric activity coefficient of the ions is derived. Applied to existing data for the variation of the dielectric constant of aqueous solutions of LiCl, NaCl and KCl the expression enables a constant (temperature dependent) to be calculated which is interpreted as the mean surface area of the unhydrated ion which is effective in ion–solvent interaction. W.Good

537.226.1

1252. POLARIZATION OF DIELECTRICS BY SLOW PARTICLES. III. H.Pelzer.
Rep. Brit. Elect. Res. Assoc., Rep. L/T316, 10 pp. (1954).

For previous papers see Abstr. 1894 (1949), 3504 (1951). An expression for the dissipated energy, taking into account electronic as well as ionic polarizability is derived from an expression due to Fröhlich and Platzman by a short method, made possible by a delta function relation of Gross and Pelzer. The expression for electric energy and other relations are derived phenomenologically from the dispersion law for the permittivity. Based on this an outline for a correct calculation of the energy carried along with the particle to replace that reported in Abstr. 1894 (1949) is briefly indicated, but not carried out. A.

537.226.1

1253. DIPOLE MOMENTS OF DIELECTRIC AND SEMICONDUCTING PARTICLES. D.V.Kuz'min.
Zh. tekh. Fiz., Vol. 26, No. 9, 1880-3 (1956). In Russian.

Expressions are derived for the dipole moment of a sphere suspended in an electric field between parallel plates in terms of dielectric constants and resistivities. Direct and alternating fields are considered. The phase difference between the alternating field and the dipole moment is calculated. J.B.Arthur

537.226.1

1254. CAUSES OF FORMATION OF THE CURIE REGION IN SOME FERROELECTRIC SOLID SOLUTIONS. V.A.Isupov.
Zh. tekh. Fiz., Vol. 26, No. 9, 1912-16 (1956). In Russian.

A hypothesis that the Curie region is some ferroelectric solid solutions is due to internal stresses and fluctuation of the composition, is further developed. An estimate is made of the role of fluctuation of the composition assuming statistical distribution of ions of the solute in the crystal lattice of the solvent. Volume in which the fluctuation is examined is identified with regions which, according to Känzig, are formed in domains near to the Curie temperature. It is shown, that fluctuation of the composition can to a considerable extent explain the existence of the Curie region assuming that the "Känzig regions" decrease with increasing content of the non-ferroelectric. A possible reason for such a decrease is indicated. Z.Krasucki

537.226.2 : 541.183

1255. STUDY OF ABSORPTION, AT KILOMETRE WAVELENGTHS, OF GASES ADSORBED ON SILICA GEL OR TITANIUM OXIDE. M.H.Waldman.
J. Phys. Radium, Vol. 17, No. 5, 426-9 (May, 1956). In French.

Values of ϵ'' at 1, 10, 100 and 1000 kc/s are given for SiO_2 as a function of T and the amount of C_2H_5Cl adsorbed. The maximum value of ϵ'' is a function of frequency and the activation energy falls from 0.503 eV to 0.392 eV as the adsorption increases. Curves of ϵ''_{max} and T_{max} against quantity of C_2H_5Cl adsorbed show breaks at the point corresponding to monolayer coverage. With non-porous TiO_2 no change of properties is observed on C_2H_5Cl adsorption. D.H.Whiffen

537.226.33

1256. THE DIELECTRIC RELAXATION SPECTRUM OF GLASS. H.E.Taylor.
Trans Faraday Soc., Vol. 52, Pt 6, 873-81 (June, 1956).

The dielectric properties of a number of glasses have been measured over the frequency range 100 c/s to 16 000 c/s and at temperatures up to 450° C. Determinations at room temperatures were extended up to 100 Mc/s. Analysis of these results showed a dispersion of the dielectric constant and an associated peak of dielectric loss, and these were attributed to a dielectric relaxation involving a distribution of relaxation times. Correlation with the results of d.c. conductivity determinations indicates that the movement of the alkali ions causes the dielectric relaxation. The shape of the relaxation spectrum is the same for all the glasses, and this shape has been deduced. The distribution of relaxation times is attributed to a spread of the values of the entropy change involved. A.

537.226.8 : 621.3.015.33 : 621.315.616.9

1257. TRANSIENT ELECTRIC CURRENTS FROM PLASTIC INSULATORS. R.J.Munick.
J. appl. Phys., Vol. 27, No. 10, 1114-18 (Oct., 1956).

Change of voltage across a solid insulator produces a transient electric current. Measurements of such currents from the polymers of methyl methacrylate, monochlorotrifluoroethylene, ethylene, styrene and tetrafluoroethylene were made for times from 10 to 10^4 seconds after change in voltage at 25° C, 47° C and several points below room temperature. The current produced by applying a constant voltage to an undisturbed specimen decays as the negative nth power of the time, where n is a constant between 0.7 and 1.1. The currents from polyethylene and polytetrafluoroethylene do not conform to the superposition principle, in contradistinction to what is usually reported for solid insulators. The currents at 100 seconds exhibit maxima at −32° C for polymethyl methacrylate and at −50° C for polymonochlorotrifluoroethylene. It is suggested that permanent electric dipoles play an important role in the currents from polymethyl methacrylate and polymonochlorotrifluoroethylene. A.

537.226.8 : 621.315.618.2 : 621.3.015.5

1258. BREAKDOWN OF AIR AT MICROWAVE FREQUENCIES. L.Gould and L.W.Roberts.
J. appl. Phys., Vol. 27, No. 10, 1162-70 (Oct., 1956).

A theory for uniform field breakdown in air at microwave frequencies is developed and applied with success to predicting values of breakdown over a wide range of experimental conditions. Three distinct types of breakdown are treated; c.w. (continuous wave) breakdown, single pulse breakdown, and multipulse breakdown. The conditions for breakdown are determined from a solution of the electron continuity equation for an average electron, in which electron ionization, attachment and diffusion are the dominant mechanisms. Modulation of the electron average energy at twice the frequency of the applied field becomes important at either high pressure or low frequency and modifies the values of the breakdown field. The breakdown field strengths are shown to be determined from a single curve for each type of breakdown power, either c.w. or pulsed. These theoretical curves are in accordance with the experimental results, thus verifying the assumption and the values of the coefficients used in the theory. A.

537.226.8 : 548.7

1259. ON THE THEORY OF DIELECTRIC BREAKDOWN IN NON-IONIC CRYSTALS. B.V.Paranjape.
Rep. Brit. Elect. Res. Assoc., Rep. L/T307, 7 pp. (1954).

Assuming that Coulomb interaction between electrons is so strong that equilibrium amongst them is maintained more effectively through electron–electron interaction than through lattice–electron interaction, Fröhlich has extended his ideas on the theory of breakdown in amorphous substances to apply to pure ionic crystals. In the present paper his ideas are applied to pure non-ionic crystals. A.

537.228 : 539.216

1260. THE ORIENTATION OF FIBRES IN AN ELECTRIC FIELD. S.Whitehead; P.Larose; J.O.Isard.
Brit. J. appl. Phys., Vol. 6, No. 12, 452 (Dec., 1955)

Referring to a paper by Isard (Abstr. 5396/1955), Whitehead draws attention to application of dielectric and conducting ellipsoids for the absolute measurement of electric field strength and potential difference. It is pointed out by Larose that the same method of fibre orientation had previously been used with wool fibres. Isard comments upon the above. C.G.Morgan

537.228.1 : 621.315.612.4

1261. STABILITY OF THE PIEZOELECTRIC EFFECT IN POLYCRYSTALLINE BARIUM TITANATE. I.P.Kozlobaev.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 20, No. 2, 195-8 (1956). In Russian.

Long observations showed that if temperature rises from room temperature remain at least 10-12° C below the Curie point of $BaTiO_3$ the piezoelectric characteristics of the material are not impaired; if kept even for short periods at temperatures close to the Curie point, the piezomodulus after cooling to room temperature is reduced by factors 1.5-2, and the dielectric constant by 5-7%. Heating to above Curie point destroys the piezoelectric character of the material. Electrical Research Association

537.228.1 : 548.5 : 621.372.412

1262. PROPERTIES OF SYNTHETIC QUARTZ OSCILLATOR CRYSTALS. C.S.Brown and L.A.Thomas.
Proc, Instn Elect. Engrs, Monogr. 205 R, publ. Oct., 1956. (Vol. 104C, 174-84).

A process for the growing of quartz crystals artificially is briefly described. This so-called synthetic quartz, which is being grown reproducibly as well-formed crystals weighing about 1.35 grammes, possesses electrical and mechanical properties which closely follow those of the natural Brazilian quartz commonly used for piezoelectric purposes. The high overall quality of synthetic quartz, its freedom from twinning and other faults and its regular shape and size make it a convenient material to handle with the minimum of wastage. Measurements have been carried out to compare the properties of oscillator crystals cut from natural and synthetic quartz. The behaviour of the AT- and BT-cuts has been investigated thoroughly, while some results have also been obtained on units of the CT-, DT- and 5° X-cuts. Most of the parameters measured show no appreciable difference between the values for natural and synthetic quartz. Two notable exceptions are a small difference in the frequency/temperature characteristics of AT-cut units, whether operated at fundamental or at overtone frequencies, and an apparently reduced activity of face-shear-mode units of the CT- and DT-cuts from the synthetic material. The significance of these results is discussed, together with the possibility of more accurate measurements to compare the intrinsic mechanical losses in natural and synthetic quartz. A.

537.228.1

1263. THE INFLUENCE OF THE CONDITIONS OF POLARIZATION ON PIEZOCHARACTERISTICS OF BARIUM TITANATE. S.V.Bogdanov, B.M.Vul and R.Ya.Razbash.
Zh. tekh. Fiz., Vol. 26, No. 5, 958-62 (1956). In Russian.

The effect of applied electric field and increase of temperature on piezomodulus d_{33} are shown. Following results are obtained: (a) thick specimens may be polarized at lower voltages and higher temperatures, (b) the nearer the temperature is to the Curie value, the lower is the voltage needed and (c) there exists a minimum value of polarizing voltage for any given temperature of polarization. M.W.Makowski

537.228.4

1264. THE KERR EFFECT IN DILUTE SOLUTIONS. A.D.Buckingham.
Trans Faraday Soc., Vol. 52, Pt 5, 611-14 (May, 1956).

The rigorous statistical-mechanical theory of the Kerr effect is applied to a dilute solution in which there is no interaction between the solute molecules. If the solvent is comprised of spherically symmetric molecules, then the molecular Kerr constant of a non-polar solute is found to be equal, to a good approximation, to its value in the gaseous state. Although the theoretical position is usually more complicated for polar solutes, it is possible to relate the molecular Kerr constant to the apparent solution moment and to the anisotropy of polarizability of the solute, provided the dissolved molecules are strongly polar and anisotropically polarizable. A.

537.242

1265. THEORY OF THE CHARGE OF SUBMICRONIC PARTICLES IN IONIZING ELECTRIC FIELDS; SPEED OF PRECIPITATION OF SUCH PARTICLES. R.Cochet.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 243-6 (July 16, 1956). In French.

The classical law of charge for micronic particles is corrected to permit its application to submicronic particles. Estimated of precipitation rates based on this law are compared with those of Pauthenier (Abstr. 6121, 7945/1955) and H.J.White (Abstr. 4243 B/1951, Trans. Amer. Inst. Elect. Engrs II, Vol. 70, 1186, 1951). C.G.Morgan

ELECTRIC CONDUCTION. CURRENTS 537.3

537.311.1

1266. MEAN FREE PATH OF ELECTRONS IN LIQUID AND AMORPHOUS CONDUCTORS. A.I.Gubanov.
Zh. tekh. Fiz., Vol. 26, No. 8, 1651-6 (1956). In Russian.

Scattering at various kinds of "defects" is considered. These include vacancies, variations in magnitude of potential maxima and minima, impurity atoms, vacant sites and interstitial atoms, as well as thermal oscillations (phonons). The mean free path due to each is calculated separately and the reciprocal sum gives the resultant mean free path. The dependence on electron energy and on temperature are explained. J.B.Arthur

537.311.2

1267. THE INFLUENCE OF INTERELECTRONIC COLLISIONS AND OF SURFACES ON ELECTRONIC CONDUCTIVITY. H.Fröhlich, B.V.Paranjape, C.G.Kuper and S.Nakajima.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 842-5 (Aug., 1956).

It is shown that Ohm's law must be generalized to include terms describing a viscous flow. The formalism can be used to discuss surface effects in thin conductors, and also the effect of interelectronic collisions which may be important for semiconductors. E.H.Sondheimer

537.311.3

1268. THE ELECTRICAL CONDUCTIVITY OF COMPOSITE MEDIA. E.H.Kerner.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 802-7 (Aug., 1956).

A general theory is given of the gross electrical conductivity (or thermal conductivity, dielectric constant or magnetic permeability) of a composite medium having its isotropic granular components distributed spatially in a disordered way. It is shown that the gross conductivity is a weighted superposition of the component conductivities with weights containing the volume fractions of the components and an intensity factor depending on the average electric field for the whole medium and for each component. By introducing a suitably defined "average electrostatic problem", the case of grains spherical in the mean and suspended in a uniform medium is examined in detail, and the gross conductivity explicitly found. The limiting case in which the suspending fluid is withdrawn and the grains coalesce is shown to give rise to a discontinuity in the gross conductivity. Coated grains, e.g. oxide-coated metallic grains, are also treated. A.

537.311.31

1269. TOWARDS THE THEORY OF THE ANOMALOUS SKIN EFFECT. M.I.Kaganov and M.Ya.Azbel'.
Dokl. Akad. Nauk SSSR, Vol. 102, No. 1, 49-51 (1956). In Russian.

Recently a large number of papers have appeared discussing the dependence of the surface impedance $Z = (4\pi/c)(E/H)_0$ of metals on the mean free path of the conduction electrons. Sondheimer (Abstr. 7432/1954) introduced anisotropy of the metal by using anisotropic effective masses and obtained explicit expressions for the limiting case where the effective mean free path is considered infinite and the current considered due to electrons moving parallel to the surface of the metal. Pippard (Abstr. 7433/1954) obtained an expression for Z valid for an arbitrary dispersion law for the electrons. In this paper an exact expression is found, for an arbitrary dispersion law, for the limit of an infinitely large mean free path. It is shown that: (1) The dependence of the impedance on the angle between the surface normal and the crystal axes is determined by a tensor. (2) The impedance varies with frequency as $\omega^{2/3}$ and the relation between ReZ and ImZ does not depend on the dispersion law. (3) The expressions for Z do not contain quantities depending on collisions with the lattice which permits their use for the determination of the shape of the Fermi surface. W.Bardsley

537.311.31

1270. THE ANOMALOUS SKIN EFFECT WITH ARBITRARY COLLISION INTEGRAL. M.Ya. Azbel' and E.A.Kaner.
Zh. éksper. teor. Fiz., Vol. 29, No. 6 (12), 876-8 (1955). In Russian.
English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 749-51 (July, 1956).

At temperatures large compared with the Debye temperature the collision integral can be written in a precise form involving the relaxation time. In a previous paper (see preceding abstract) an expression for the surface impedance of a metal exhibiting the anomalous skin effect has been derived for these conditions. At lower temperatures an arbitrary form has to be assumed for the collision integral and the present paper shows that this assumption does not change the form of impedance previously derived.
G.D.Sims

537.311.31 : 538.632

1271. PHYSICAL PROPERTIES OF TITANIUM. II. THE HALL COEFFICIENT AND RESISTIVITY. G.W.Scovil.
J. appl. Phys., Vol. 27, No. 10, 1196-8 (Oct., 1956).

For Pt I, see Abstr. 2448 (1950). The Hall coefficient of titanium has been measured over a temperature range from 350°K to 1100°K. The coefficient is -2.0×10^{-11} m^3/coulomb near room temperature, reverse sign at (675 ± 30)°K, and increases to a value of $+3.5 \times 10^{-11}$ m^3/coulomb at 1100°K. The measurements were made on titanium samples which had a purity of 99.99%. The samples were heated by direct current, and the temperatures were determined indirectly from the resistivity measurements which were made with each Hall measurement. The resistivity is 4.8×10^{-7} ohm m at 350°K. It increases to a maximum of 1.76×10^{-6} ohm m at the crystal transition temperature. A.

537.311.32 : 538.63

1272. HALL EFFECT AND MAGNETORESISTIVITY IN CARBONS AND POLYCRYSTALLINE GRAPHITES. S.Mrozowski and A.Chaberski.
Phys. Rev., Vol. 104, No. 1, 74-83 (Oct. 1, 1956).

The Hall constant and magnetoresistance of a carbon (soft type) were investigated as a function of heat treatment temperature, T_{ht}, (that is, crystallite size) at two ambient temperatures T (78° and 300°K). The maximum in the Hall constant shifts toward higher heat treatments as the ambient temperature is lowered, in much the same way as does the maximum in the thermoelectric effect. Anomalies in the Hall curves in the range $1600 < T_{ht} < 1900$°C are shown to be due to impurities. No magnetoresistance is detectable for $T_{ht} < 1700$°C; the magnetoresistance was found to be negative in the range $1700 < T_{ht} < 2300$°C and to be positive and rapidly increasing with T_{ht} above that. For both ambient temperatures the maximum of negative magnetoresistance occurs at about the same T_{ht} as the maximum of the Hall constant. Introduction of acceptors changes the magnetoresistance in the direction of lower T_{ht}. The value of magnetoresistance and of Hall constant show a sensitive dependence on the alignment of crystallites in the samples. The results are interpreted in terms of the band model. It is concluded that the lower (full) and upper (empty) bands are slightly overlapping in graphite crystals, and furthermore, that the negative magnetoresistance is due to holes in the lower band and the positive magnetoresistance as well as the high diamagnetic susceptibility are due to electrons in the upper band. Remarks about the thermoelectric effect and electrical resistance are also included. A.

537.311.33

1273. THEORY OF THE SWEPT INTRINSIC STRUCTURE. W.T.Read, Jr.
Bell Syst. tech. J., Vol. 35, No. 6, 1239-84 (Nov., 1956).

The electric field and the hole and electron concentrations are found for reverse biased junctions in which one side is either intrinsic (i) or so weakly doped that the space charge of the carriers cannot be neglected. The analysis takes account of space charge, drift, diffusion and nonlinear recombination. A number of figures illustrate the penetration of the electric field into a p-i-n structure with increasing bias for various lengths of the i region. For the junction between a highly doped and a weakly doped region, the reverse current increases as the square root of the voltage at high voltages; and the space charge in the weakly doped region approaches a constant value that depends on the fixed charge and the intrinsic carrier concentration. The mathematics is greatly simplified by expressing the equations in terms of the electric field and the sum of the hole and electron densities. A.

537.311.33 : 621.315.59

1274. SURFACE RECOMBINATION AND THE "LIGHT-DISC" METHOD OF MEASURING BULK-LIFETIME IN SEMICONDUCTORS. J.Butterworth.
J. Electronics, Vol. 1, No. 3, 293-6 (Nov., 1955).

Presents the results of an analysis of a model using a disk source of carriers on the surface of the semiconductor. The radius of the disk is assumed comparable with the diffusion length of the minority carriers giving an increase in signal strength and a reduction in the optical diffraction effects compared with a point source. Two expressions useful for the analysis of experimental data are given together with the range of surface recombination values over which each expression is the more useful. W.Bardsley

537.311.33 : 538.63 : 539.31

1275. ELASTORESISTANCE AND MAGNETORESISTANCE IN MULTIVALLEY SEMICONDUCTORS WITH AN AXIS OF SYMMETRY. R.W.Keyes.
J. Electronics, Vol. 2, No. 3, 279-92 (Nov., 1956).

A multivalley model of the energy bands of a crystal with an axis of 3-, 4- or 6-fold symmetry is described. The anisotropy in the properties of a single valley is expressed in terms of two second rank tensors: α, the effective mass tensor, and β, a tensor which relates the energy of an electronic state to the elastic strain. Expressions for the fourth rank magnetoresistance and elastoresistance tensors in terms of α and β are derived. The application of the results to crystals with additional symmetry elements is explained. A.

537.311.33 : 534.39

1276. ACOUSTODYNAMIC EFFECTS IN SEMICONDUCTORS. G.Weinreich.
Phys. Rev., Vol. 104, No. 2, 321-4 (Oct. 15, 1956).

The presence in a semiconductor of both signs of current carriers makes it possible to disturb the spatial distribution of these carriers appreciably without giving rise to electrical space charge. As a result, the interaction of particles with acoustic waves leads to certain effects which, at least at low frequencies, are peculiar to semiconductors; these include a (complex) addition to the elastic modulus and the "acousto-electric effect". A.

537.311.33

1277. AVALANCHE INJECTION IN SEMICONDUCTORS. J.B.Gunn.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 781-90 (Aug., 1956).

It is predicted on theoretical grounds that additional charge carriers may be injected into a semiconductor by a thin region of high electric field in which avalanche multiplication occurs. The voltage drop across the region may be quite low and associated with a negative resistance for certain values of the current. The observation of the predicted phenomena in germanium is described; it is found that the negative resistance region may cover some hundreds of volts and the response time be as short as 3×10^{-9} sec. The implications of avalanche injection are discussed in connection with solid-state phenomena involving a large current density, and it is shown that any sufficiently small contact is capable of rectification independently of the presence of potential barriers. A.

537.311.33

1278. BIPOLAR DIFFUSION OF CURRENT CARRIERS IN THE PRESENCE OF DEEP TRAPS. K.B.Tolpygo and É.I.Rashba.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 273-7 (1956). In Russian.

Bipolar diffusion in the presence of traps has been studied with consideration of the minority carriers. The lifetime dependence on the degree of occupation of the traps; criteria of validity of a linear recombination law have been established. A formula for the distribution of the minority carriers under conditions of a non-linear recombination law has been deduced. A.

537.311.33

1279. A GRAPHICAL METHOD OF DETERMINING THE CHEMICAL POTENTIAL IN SEMICONDUCTORS.
L.L.Korenblit and A.A.Shteĭnberg.
Zh. tekh. Fiz., Vol. 26, No. 5, 927-37 (1956). In Russian.

A simple method using curves of various functions superimposed on a plotting table is described. The chemical potential (Fermi level) and its temperature dependence are readily obtainable with reasonable accuracy. The utility of the method is shown by calculations of (a) thermoelectric power in a material with mixed conduction and (b) the conductivity of heavily doped Si. C.H.L.Goodman

537.311.33 : 538.614

1280. THE QUESTION OF THE FARADAY EFFECT IN SEMICONDUCTORS. M.I.Klinger and M.M.Chaban.
Zh. tekh. Fiz., Vol. 26, No. 5, 938-40 (1956). In Russian.

A theoretical paper on possible applications of the Faraday effect. It is pointed out for an atomic semiconductor (single-carrier) that (a) the Verdet constant, V, is proportional to the reciprocal of the carrier effective mass to the 17/4 power, (b) the product of V and the Hall constant varies as the square of the carrier mobility, (c) the ratio of V to the conductivity is proportional to the carrier mobility. Calculated values of V are given for n- and p-type Ge and Si (at 300°K, 10^{16} carriers/cm^3). The large value of 0.393 is predicted for n-type Ge. This would lead to a Faraday rotation of about 23 degrees for a field strength of 10^4 gauss and a specimen thickness of 10^{-4} cm (see also Abstr. 2086/1956). C.H.L.Goodman

537.311.33 : 548.7

1281. MICROSCOPIC EXAMINATION OF GERMANIUM CRYSTALS AND TRANSISTORS. S.G.Ellis.
"Transistors". pp. 97-111. See Abstr. 385 (1957).

This paper discusses the techniques which may be employed in the microscopy of germanium crystals, and the information which may be obtained by the examination of such crystals and of transistors which are made from them. Microscopy is valuable as a supplementary method of examination since it permits a point-by-point study whereas most other methods, such as electrical, mechanical, or thermal methods yield volume-average results. Useful information may be obtained regarding crystal orientation, twinning, junctions, defects and dislocations, small-angle grain boundaries, and the external and internal structure of transistors. A.

537.311.33

1282. CALCULATIONS OF ALLOYING DEPTH OF INDIUM IN GERMANIUM. L.Pensak.
"Transistors", pp. 112-20. See Abstr. 385 (1957).

A method is described for calculating the depth of alloying of indium in germanium for two simple cases of indium shapes. The results are presented in a graphical form convenient for use. Some limitations on the general applicability of the calculations are described briefly. A.

537.311.33 : 538.61

1283. ON THE TRANSVERSE PHOTOMAGNETIC EFFECT IN N- AND P-GERMANIUM. I.K.Kikoin and Yu.A.Bykovskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 735-6 (1956). In Russian.

If a rectangular specimen is illuminated in the y-direction, a magnetic field in the x-direction produces a photomagnetic e.m.f. in the z-direction. A transverse photomagnetic e.m.f. is set up in the x-direction if the magnetic field has a component in the y- as well as the x-direction. The magnitude of the effect has been observed in 40 ohm cm n-type and 45 ohm cm p-type germanium. An e.m.f. of 1 or 2 x 10^{-3} V was measured using fields of the order of 2 x 10^4 oersted. The e.m.f. goes through a maximum with increase of field and eventually changes sign. The field for maximum e.m.f. increases with temperature. The temperature dependence at 2 x 10^4 oersted is plotted. J.B.Arthur

537.311.33 : 548.5

1284. EFFECTS OF GROWTH RATE ON CRYSTAL PERFECTION AND LIFETIME IN GERMANIUM. A.D.Kurtz, S.A.Kulin and B.L.Averbach.
J. appl. Phys., Vol. 27, No. 11, 1287-90 (Nov., 1956).

Effects of crystal growth rate and growth direction on the density of random dislocations and on the minority carrier lifetime have been observed. The dislocation density increases rapidly with growth rate above a rate of about 0.15 in. per minute and varies somewhat with growth direction. The capture efficiency per unit length of dislocation decreases at high growth rates and it is suggested that this effect is caused by the failure of impurity atoms to segregate at dislocations or by the clustering of dislocations. A.

537.311.33

1285. THE MEASUREMENT OF DRIFT MOBILITY IN GERMANIUM AT HIGH ELECTRIC FIELDS. A.F.Gibson and J.W.Granville.
J. Electronics, Vol. 2, No. 3, 259-66 (Nov., 1956).

A new technique for the measurement of the drift mobility of minority carriers in germanium is described. The emitter and collector contacts of a conventional drift mobility specimen are replaced by a light spot and a section of suitable waveguide respectively. Detection of minority carriers at the waveguide relies on the increased microwave absorption due to the added carriers. The technique may be applied successfully under conditions which preclude the adoption of the conventional method. In particular the technique may be used at high electric fields when the carrier drift velocity is no longer proportional to the applied field and when the minority carrier lifetime is very small. The former feature has been exploited in the present work. The latter feature suggests that the technique may be applicable to Group III—Group V compounds and other semiconductors. A.

537.311.33

1286. SURFACE CONDUCTANCE AND THE FIELD EFFECT ON GERMANIUM. J.Bardeen, R.E.Coovert, S.R.Morrison, J.R.Schrieffer and R.Sun.
Phys. Rev., Vol. 104, No. 1, 47-51 (Oct. 1, 1956).

Measurements of the steady-state surface conductance and the change in this conductance with transverse electric field (field effect) have been made on a free germanium surface as a function of the gaseous ambient. The results can be understood in terms of two sets of surface states: one dependent upon the gaseous ambient and with a large density and long time constants, probably located at the outer surface of an oxide layer, and the other a set with much smaller density but shorter time constants, probably located at the germanium–germanium oxide interface. The interface states consist of a discrete state with free energy 0.13-0.15 eV below the intrinsic Fermi energy and density 1 – 3 x 10^{11} states/cm^2, and a small continuous distribution. There is also indication of a discrete state greater than 0.13 eV above the intrinsic Fermi energy. The measurements suggest that surface scattering effects become important for large barrier layers. A.

537.311.33

1287. SCATTERING OF HOLES BY PHONONS IN GERMANIUM. H.Ehrenreich and A.W.Overhauser.
Phys. Rev., Vol. 104, No. 2, 331-42 (Oct. 15, 1956).

The lattice scattering of holes within and between the two valence bands of germanium, degenerate at k = 0, is calculated. Scattering by both acoustical and optical modes is considered. The electron-lattice interaction Hamiltonian is seen to be separable into two parts: the first, associated with acoustical modes, arises from vibrations of the unit cells as a whole and the other, associated with both acoustical and optical modes, arises from the relative motion of the two atoms in the unit cell of the germanium lattice. The matrix elements for scattering are expressible in terms of two constants, C_1 and C_4, associated respectively with the two parts of the interaction Hamiltonian. The wave-functions used to calculate the matrix elements are determined by k·p and spin-orbit perturbations and assume spherical surfaces of constant energy in k-space and a parabolic relation between energy and wave number. For the terms in C_1 the scattering is treated using both the deformable and rigid ion models. The angular distributions for scattering are such that heavy holes are scattered predominantly in the forward direction and light holes in the backward direction for the deformable ion model, whereas the opposite is true for the rigid ion model. The scattering resulting from transverse and longitudinal phonons is about equally important for deformable ions; for rigid ions scattering by transverse modes is less significant. The matrix elements depending on

C_4 are obtained from the rigid ion model alone. The transition probabilities for scattering are presented in a form which can be applied readily to the transport properties of germanium. A.

537.311.33 : 538.63

1288. HIGH-FIELD LONGITUDINAL MAGNETORESISTANCE OF GERMANIUM. H.P.Furth and R.W.Waniek.
Phys. Rev., Vol. 104, No. 2, 343-5 (Oct. 15, 1956).

The longitudinal magnetoresistance of germanium N_{100}, N_{111}, P_{100}, P_{111} and P_{211} single crystals of 2 ohm cm resistivity has been measured, to the point of saturation, by means of transient magnetic fields up to 600 000 gauss. An n-type effective mass ratio of 17.2 ± 0.4 has been determined at 300°K. The magnitude and variation with field of the p-type magnetoresistances was found to be anomalous. A.

537.311.33

1289. THE TEMPERATURE DEPENDENCE OF THE MOBILITY OF ELECTRONS IN GERMANIUM. D.M.Evans.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 845-6 (Aug., 1956).

Measurements of the current amplification factor α with temperature are reported for an n–p–n transistor and by means of Shockley's equation for α the mobility is calculated from the results. Electron mobility is then found to vary as $T^{-1.66}$ in accordance with the conductivity results of Morin. C.A.Hogarth

537.311.33

1290. ELECTRICAL PROPERTIES OF Ge AT VERY LOW TEMPERATURES. É.I.Abaulina-Zavaritskaya.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1158-60 (1956). In Russian.

The resistivity of specimens, whose room temperature value was 1 ohm cm, has been measured in the range 0.15°K to 4.2°K. Precautions were taken against the effects of room temperature radiation and too high electric fields. Two activation energies were found, the one in the range 0.15 to 1°K being smaller than that in the range 1.6 to 4.2°K. The variation of resistivity with electric field at various temperatures is also shown. At fields below the breakdown field, two slopes are observed, a steep one for the very low temperature region running into a less steep one at about 1.77°K. J.B.Arthur

537.311.33

1291. DEPENDENCE OF THE LIFETIME OF NON-EQUILIBRIUM CHARGE CARRIERS IN GERMANIUM ON TEMPERATURE AND COMPOSITION. É.I.Adirovich, G.M.Guro and V.F.Kuleshov.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 261-72 (1956). In Russian.

An spproximate form of the analytical dependence of the position of the Fermi level on temperature and the composition has been derived for a semiconductor with a low concentration of traps. The expressions thus obtained are used to investigate the dependence of the lifetime of non-equilibrium charge carriers for small thermodynamic equilibrium; this in turn permits one to refine the departures from formula for the binding energy of electrons and holes in the traps. A.

537.311.33

1292. THE EFFECT OF IMPURITIES ON THE LIFETIME OF EXCESS CHARGE CARRIERS IN Ge. A.V.Rzhanov.
Zh. tekh. Fiz., Vol. 26, No. 7, 1389-93 (1956). In Russian.

The lifetime was measured in doped single crystals of n- and p-type Ge as a function of temperature and of equilibrium carrier concentration. The two measurements in conjunction with each other can be used to give a unique value of the energy level of recombination centres. For n-type Ge these occurred in the lower half of the forbidden zone and vice versa. J.B.Arthur

537.311.33

1293. SOME ELECTRICAL CHARACTERISTICS OF SINGLE CRYSTAL IRON MONOTELLURIDE. D.M.Finlayson, D.Greig, J.P.Llewellyn and T.Smith.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 860-2 (Aug., 1956).

The crystal was grown from a mixture of iron and tellurium, the resulting composition being about Fe $Te_{0.93}$. The electrical conductivity fell with temperature between ambient and 40°K, then remained constant. The absence of a measurable Hall effect indicated a charge carrier density in excess of 10^{20} per cm^3. The variation in conductivity is thought to be due to mobility changes only. Comparison of crystal density and lattice dimensions indicates interstitial Fe and Te ions, which are thought to play a role in determining the carrier mobility. K.W.Plessner

537.311.33

1294. ELECTRICAL MEASUREMENTS ON NATURAL GALENA AT LOW TEMPERATURES. D.M.Finlayson and D.Greig.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 796-801 (Aug., 1956).

The Hall effect and resistivity of n-type single crystals of natural galena containing from 6 x 10^{15} to 10^{19} extrinsic electrons per cm^3 have been measured from room temperature down to liquid helium temperatures. No appreciable change in the number of extrinsic electrons has been observed down to 4°K in any crystal. While the mobility is proportional to $T^{-5/2}$ down to a temperature of about 70°K, the low temperature mobility varies with the number of extrinsic electrons in a manner which cannot be explained by current theories of scattering. It is estimated that at room temperature a purely intrinsic crystal of PbS would contain 2 x 10^{15} conduction electrons per cm^3. A.

537.311.33

1295. ON THE MEASUREMENT OF MINORITY CARRIER LIFETIMES IN SILICON. C.A.Hogarth.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 791-5 (Aug., 1956).

It is shown that if high surface recombination rates can be corrected for or eliminated, then the travelling light spot method is very suitable for measurements of lifetimes in silicon since no ambiguities due to trapping effects are involved and since the measurement can readily be made on large sections of ingots instead of on carefully fashioned rods of rectangular section. Experimental results are given and treatments for the reduction of recombination velocities at surfaces of both n- and p-type silicon are described. A.

537.311.33 : 538.63

1296. GALVANOMAGNETIC PROPERTIES AND HOLE CONDUCTION IN TELLURIUM. S.S.Shalyt.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 750-2 (1956). In Russian.

Measurements, down to 1.3°K, of the Hall constant and magnetoresistive effect for zone-melted single crystals were interpreted in terms of a splitting of the valence band. Approximate analysis indicated two types of hole with mobilities of 550 and 9500 cm^2/V sec. C.H.L.Goodman

537.311.33

1297. EXPERIMENTAL INVESTIGATION OF THE TRANSVERSE NERNST–ETTINGHAUSEN EFFECT IN TELLURIUM. I.V.Mochan.
Zh. tekh. Fiz., Vol. 25, No. 6, 1003-12 (1956). In Russian.

Measurements of the Nernst and the Hall effects on specimens of polycrystalline Te were used to derive values of carrier mobility. The values obtained by the two methods differed appreciably. A theoretical analysis suggested that this was largely due to the presence of more than a single type of carrier. The Nernst effect was shown to be much more sensitive than the Hall effect to the presence of a small proportion (i.e. 5%) of a second carrier. C.H.L.Goodman

537.311.33

1298. ANOMALOUS CHARACTERISTICS OF SILICON POINT CONTACT RECTIFIERS. D.J.Kyte.
J. Electronics, Vol. 2, No. 3, 247-58 (Nov., 1956).

Silicon point-contact rectifiers have been subjected to groups of narrow voltage pulses, produced by the discharge of a small condenser. When the pulse energy exceeds a critical value, the reverse current–voltage characteristics of the rectifiers exhibit marked discontinuities. At the same time, a significant drop in the rectification efficiency and an increase in the noise output occurs. A tentative explanation is put forward in terms of the formation of minority carrier traps in the silicon lattice. A.

537.311.33

1299. DIRECT METHOD OF MEASURING THE CONTACT INJECTION RATIO. O.L.Curtis, Jr and B.R.Gossick.
Rev. sci. Instrum., Vol. 27, No. 10, 828-9 (Oct., 1956).

A direct method of measuring the injection ratio of rectifying contacts is described. With this method, the injection ratio is determined by comparing the area of a current injection pulse with the area of the resulting hole storage pulse as observed on an oscilloscope screen. A.

537.311.33

1300. AMBIPOLAR DIFFUSION IN SEMICONDUCTORS AT LARGE CURRENTS. K.B.Tolpygo and I.G.Zaslavskaya.
Zh. tekh. Fiz., Vol. 25, No. 6, 955-77 (1955). In Russian.

The equations for ambipolar diffusion are solved for a semiconductor in which occurs an inversion of the type of conduction due to a

contact field or an inhomogeneous impurity concentration. The behaviour of the forward current is studied for the cases of planar and hemispherical contacts. It is shown that, at large currents, in addition to the saturation of the blocking layer by current carriers, an essential part is played by injection of carriers of one sign into the region of the opposite sign. As a result, the total resistance of the system becomes significantly smaller than the resistance of a homogeneous semiconductor of the same thickness with no blocking layer. Typical forward current–voltage characteristics are illustrated.
J.B.Arthur

537.311.33

1301. ON THE REASONING IN THE PAPER OF K.B.TOLPŸGO AND I.G.ZASLAVSKAYA "AMBIPOLAR DIFFUSION IN SEMICONDUCTORS AT LARGE CURRENTS". A.I.Gubanov and L.L.Makovskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 9, 2126-7 (1956). In Russian.
Indicating that one of the approximations made by Tolpÿgo and Zaslavskaya (see preceding abstract) is invalid. J.B.Arthur

537.311.33

1302. REMARKS ON THE LETTER OF GUBANOV AND MAKOVSKIĬ ON THE REASONING IN THE PAPER OF TOLPŸGO AND ZASLAVSKAYA "AMBIPOLAR DIFFUSION IN SEMICONDUCTORS AT LARGE CURRENTS". K.B.Tolpÿgo
Zh. tekh. Fiz., Vol. 26, No. 9, 2127-8 (1956). In Russian.
See two preceding abstracts. The author (Tolpÿgo) maintains that his theoretical solutions have been confirmed by experimental evidence.
J.B.Arthur

537.311.33

1303. FORWARD CURRENT–VOLTAGE CHARACTERISTIC OF A PLANAR RECTIFIER AT LARGE CURRENTS. É.I.Rashba and K.B.Tolpÿgo.
Zh. tekh. Fiz., Vol. 26, No. 7, 1419-27 (1956). In Russian.
The calculation is made of the characteristic of a p–n junction diode of arbitrary thickness, assuming large current density. It is assumed that most of the voltage drop occurs in the body of the semiconductor. Solutions are obtained for both linear and bimolecular recombination laws. J.B.Arthur

537.312.5

1304. EFFECT OF HYDROGEN ON THE PHOTOCONDUCTIVITY OF SOLID FILMS OF DYES. A.T.Vartanyan.
Dokl. Akad. Nauk SSSR, Vol. 94, No. 5, 829-32 (1954). In Russian.

537.312.5

1305. PHOTOCONDUCTIVITY SPEED OF RESPONSE FOR HIGH INTENSITY EXCITATION IN CADMIUM SULFIDE AND SELENIDE. R.H.Bube.
J. appl. Phys., Vol. 27, No. 10, 1237-42 (Oct., 1956).
The rise and decay time of photoconductivity in single crystals, sintered layers and evaporated layers of cadmium sulphide and cadmium senelide with a wide range of sensitivities, has been measured for excitation at room temperature by a 1900°K incandescent source giving 1740 lm/ft^2 illumination on the sample. The data thus obtained are useful for determining the dependence of the speed of response on the sample's photosensitivity and for estimating a practical upper limit to the speed of response of these photoconductors. The minimum response times found for the samples tested were rise time of 250 μsec and decay time of 300 μsec for cadmium sulphide and rise time of 17 μsec and decay time of 8 μsec for cadmium selenide. A.

537.312.5

1306. THE RESISTANCE OF SEMITRANSPARENT PHOTOCATHODES. W.J.Harper and W.J.Choyke.
J. appl. Phys., Vol. 27, No. 11, 1358-60 (Nov., 1956).
The resistance of the semitransparent photoemissive films Sb-Cs, Sb-Rb, Bi-Cs, Bi-Rb, Te-Cs, Te-Rb and Ag-O-Cs was measured as a function of temperature. A thermal activation energy associated with conductivity was determined for each of the materials. A.

537.312.5

1307. LONG TIME CONSTANTS IN SELENIUM PHOTOCELLS. G. Blet.
J. Phys. Radium, Vol. 17, No. 5, 430-9 (May, 1956). In French.
Various phenomena are discussed such as the fatigue observed after intense or prolonged excitation, the delay in response to a feeble excitation, and other effects allied to these. A theory involving free electrons and holes in the barrier region and some trapping processes, is found to give a qualitative explanation of long time constants (> 1 min) resulting from the above phenomena.
C.A.Hogarth

537.312.5

1308. TRACER EXPERIMENTS IN PHOTOCELLS. W.E.Turk.
J. Electronics, Vol. 2, No. 3, 267-9 (Nov., 1956).
A method is developed of observing the distribution of caesium in vacuum photocells by radioactivity. A.

537.312.5 : 537.533.8

1309. THE ADDITIVE EFFECT OF PHOTOEMISSION AND SECONDARY ELECTRON EMISSION OF METALS. L.I.Ekertova.
Zh. tekh. Fiz., Vol. 26, No. 8, 1665-8 (1956). In Russian.
The experimental set-up for the measurement of photo- and secondary electron emission of Mg and Al is briefly indicated. Measurements support the theoretical expectation of full superposition of both emissions contrary to Dember's investigations (1925) for both metals in their pure and slightly oxidized forms. A.Landman

537.312.5 : 535.37

NEGATIVE LUMINESCENCE AND NEGATIVE PHOTOEFFECT. See Abstr. 1193

537.312.62

1310. DIFFERENCE BETWEEN NORMAL AND SUPERCONDUCTING STATES OF A METAL. G.V.Chester.
Phys. Rev., Vol. 103, No. 6, 1693-9 (Sept. 15, 1956).
Three general theorems of statistical mechanics are used to calculate the differences, between the normal and superconducting states of a metal in (i) the mean kinetic energy of the electrons, (ii) the mean kinetic energy of the lattice, and (iii) the mean potential energy of the entire system. The word "mean" implies thermal average at a given temperature and pressure. The formal properties of these differences are established and a numerical calculation is carried out in the case of tin. The most important results of this investigation are that (a) all three differences are of the same order of magnitude ($\sim 10^{-3}$ cal/mole for a typical superconductor) at all temperatures, (b) they all vanish at the transition temperature, (c) the mean kinetic energy of the electrons is greater in the superconducting state than in the normal state and depends strongly on the isotopic mass, (d) the mean kinetic energy of the lattice is less in the superconducting state than in the normal state and depends equally strongly on the electron mass, and (e) the mean potential energy of the entire system is also less in the superconducting state than in the normal state. In the final section these results are discussed from a physical point of view. A.

537.312.62

1311. CRYSTALLINE ANISOTROPY OF THE INTERMEDIATE STATE OF TIN. Yu.V.Sharvin and V.L.Sedov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 897 (1955). In Russian.
English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 771 (July, 1956).
In suitable conditions a couple is exerted by a magnetic field on a superconducting single-crystal tin sphere in the intermediate state, due to anisotropy of the surface energy between normal and superconducting phases. D.Shoenberg

537.312.62

1312. THE SUPERCONDUCTIVITY OF BORIDES, CARBIDES, NITRIDES AND SILICIDES OF TRANSITION METALS.
G.V.Samsonov and V.S.Neshpor.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1143 (1956). In Russian.
The author discusses the dependence of the transition temperature on the chemical composition within the series of compounds of Ti, Zr, V, W etc. with B, C, N and Si. Surveying a large number of compounds it is found that the transition temperature tends to increase with increasing energy necessary for transferring an electron from a non-metallic atom to an atom of the metal.
R.Eisenschitz

537.312.62

1313. ON THE PAPERS BY BLATT, BUTLER AND SCHAFROTH ON THE THEORY OF SUPERFLUIDITY AND SUPERCONDUCTIVITY. V.L.Ginzburg.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1151-2 (1956). In Russian.
In reply to the writers named in the title, the author insists on momenta of different particles being correlated even if the distance between the particles is infinite; he con-

siders the arguments by which a finite range of correlations is established to be inconclusive. The author criticizes also the attempt at specifying superconductivity and superfluidity as phenomena depending on deviation from equilibrium.

R.Eisenschitz

537.312.9

1314. THE EFFECT OF HYDROSTATIC PRESSURE ON THE ELECTRICAL RESISTIVITY OF METALS. A.W.Lawson.
Progress in metal physics, Volume 6, 1-44. See Abstr. 7097 (1956).

A review. Tabulates Bridgman's data on the compression change of resistance and specific volume for all the metals investigated and for pressures up to 10^5 kg cm^{-2}. The experimental methods used are described. The results for normal and abnormal metals are discussed. Experimental data on ordered alloys, superconductors and metals at the melting point are also considered. References to tabulated data plus 56 other references.

E.P.Wohlfarth

537.323

1315. CHANGES IN THERMOELECTRIC POWER OF COPPER WITH COLD WORK AT LIQUID NITROGEN TEMPERATURE. E.W.Kammer.
Phys. Rev., Vol. 104, No. 1, 265 (Oct. 1, 1956).

Changes in the thermoelectric power were measured after the metal in the form of a 0.001 in. diameter wire 9 in. long had been permanently elongated in stages at liquid nitrogen temperature. The results suggest that the effect of vacancies on the thermoelectric power is in the opposite sense to that for dislocations.

C.A.Hogarth

537.323

1316. THERMOELECTRIC PROPERTIES OF Cd–Sb ALLOYS. V.A.Yurkov and N.E.Alekseeva.
Zh.tekh. Fiz., Vol. 26, No. 4, 911-12 (1956). In Russian.

The variation of thermoelectric power with composition was studied. A very sharp maximum (285 μV/deg C.) was found at the composition CdSb. A secondary maximum appeared to be associated with the (metastable) compound Cd_3Sb_2

C.H.L.Goodman

537.323.08

1317. METHODS OF MEASURING THE COEFFICIENT OF THERMO-E.M.F. IN SEMICONDUCTORS. G.I.Skanavi and A.M.Kashtanova.
Zh. tekh. Fiz., Vol. 26, No. 4, 895-9 (1956). In Russian.

A discussion of practical difficulties in measuring thermoelectric power is followed by a detailed description of two different types of apparatus suitable for use from room temperature up to (a) 240° C, (b) 320° C.

C.H.L.Goodman

537.36

1318. A NEW METHOD OF EXPRESSION OF ELECTROKINETIC DATA. D.J.O'Connor.
Recueil Trav. chim. Pays-Bas, Vol. 75, No. 7, 938-42 (July, 1956).

The usefulness of the fundamental electrokinetic ratio $\zeta D/4\pi\eta$ for expression of double layer properties in terms of experimentally measured quantities is discussed and, when electrostatic units are used, the ratio $\zeta D/4\pi\eta$ is shown to have dimensions equivalent to the reciprocal of the e.s.u. magnetic induction or magnetic flux/cm^2. It is proposed that the ratio $\zeta D/4\pi\eta$ be assigned the symbol G, and the unit of one (e.s.u. magnetic flux/cm^2)$^{-1}$ be called the Gouy.

A.

ELECTRIC DISCHARGES 537.52

537.52

1319. FUNDAMENTAL PRIMARY PROCESSES IN GASEOUS DISCHARGES. H.S.W.Massey.
Appl. sci. Res. B, Vol. 5, No. 1-4, 1-9 (1955).

In recent years there has been considerable progress in our knowledge of the rates of the primary processes which occur in gaseous discharges. A brief review will be given of these developments. Although phenomena occurring at electrode surfaces are clearly of great importance in many discharges no mention of these will be made — an account of some of these surface effects is given in the paper by Hagstrum. Ionization and excitation by electron impact, diffusion and recombination are here considered in more detail. Processes involving negative ions and metastable atoms, transfer of excitation and ionization by positive ions and by neutral atoms are dealt with only in summary fashion.

A.

537.52

1320. SECONDARY PROCESSES ACTIVE IN ELECTRICAL BREAKDOWN OF GASES. L.B.Loeb.
Appl. sci. Res. B, Vol. 5, No. 1-4, 10-15 (1955).

Electrical breakdown and spark breakdown being defined, the advantages of studying breakdowns using asymmetrical gaps are indicated. Then denoting the principal mechanisms active in breakdown, a number of exemplary breakdown processes are described in detail as revealed by modern techniques. The examples indicate the very sensitive nature of the breakdown process in regard to state of electrodes, gaseous purity, etc., as well as emphasizing the great care needed in designating the breakdown mechanism in any given case.

A.

537.52

1321. THE ELECTRON AVALANCHE AND ITS DEVELOPMENT. H.Raether.
Appl. sci. Res. B, Vol. 5, No. 1-4, 23-33 (1955).

A single electron avalanche can be detected by the following methods: (1) by means of a cloud chamber; (2) by measuring the potential drop over a series resistance which is composed of the rapid electron component and the slow ion component; (3) by detecting the light quanta, emitted especially from the head of the avalanche, with a photo-multiplier. If the multiplication exp ad is enlarged, the following processes happen: (a) the number of ions moving to the cathode and the number of light quanta increases; (b) the space charge field increases. Process (a) starts the spark by avalanches going to and fro (Townsend mechanism). Process (b) becomes important when exp ad becomes exp 20, where the streamer mechanism starts. These points are discussed in detail.

A.

537.52

1322. INTERNAL RADIATION AND NATURE OF DISCHARGES. A.von Engel.
Appl. sci. Res. B, Vol. 5, No. 1-4, 34-42 (1955).

A short survey is given of the work of measuring and analysing the radiation in the far u.v. which originates in the gas of an electric discharge. A new method is briefly described including some preliminary results.

A.

537.52

1323. INFLUENCE OF SELF INDUCTION AND AFTER-EFFECT IN GAS DISCHARGES ON THEIR STABILITY. C.van Geel.
Appl. sci. Res. B, Vol. 5, No. 1-4, 79-89 (1955).

Amongst the non-steady states of univariant gas discharges the most simple are wholly determined by the momentary values of the tension and the mean convection current. In such haplonomous states any quantity of state can also be considered as a function of one fundamental parameter a and its fluxion $\dot{a}$. With the aid of this assumption one can deduce the differential equation for the tension and the current in non-steady haplonomous states of gas discharges without and with after-effect.

A.

537.52

1324. MICROWAVE GAS DISCHARGE BREAKDOWN. S.C.Brown.
Appl. sci. Res. B, Vol. 5, No. 1-4, 97-108 (1955).

A brief survey of microwave gas discharge breakdown is given. The conditions for breakdown in electron attaching and non-attaching gases is discussed. Results for air show both electron attachment and diffusion are operating. Hydrogen is taken as an example of a gas in which electron attachment is absent. For this case, data in the low-pressure region, in the diffusion controlled region, and in the mobility controlled region are discussed and the results of the many studies in these regions are shown to be consistent with each other.

A.

537.52

1325. MICROWAVE AND OPTICAL TECHNIQUES FOR GAS DISCHARGE STUDIES. M.A.Biondi.
Appl. sci. Res. B, Vol. 5, No. 1-4, 157-66 (1955).

Some recently developed microwave and optical techniques for studying fundamental processes in gas discharges are described. Microwave apparatus which measures the change of resonant frequency and Q of a cavity containing a gas discharge is used to determine the concentration of electrons and their rate of collision with gas atoms in the discharge. Time sampling techniques are used to reduce the statistical fluctuations in data obtained in very low intens-

ity optical emission studies. These techniques have been employed in direct recording spectrographic and interferometric equipments which require orders of magnitude less "exposure time" than conventional photographic recording methods. Time sampling has also been applied to optical absorption techniques used to study metastable atoms, with a hundred-fold increase in detection sensitivity over previous methods. The use of these methods is illustrated by a brief discussion of studies of electron-ion recombination, conversion of singlet metastable atoms to triplet metastables by collisions with slow electrons, and the formation and decay of excited mercury molecules. A.

537.521.6

1326. ON THE BREAKDOWN POTENTIAL OF HIGHLY IONIZED GASES. K.Honda.
Appl. sci. Res. B, Vol. 5, No. 1-4, 47-52 (1955).

For practical applications of gas-discharge tubes their re-ignition characteristics are often required. The increase of the re-ignition potential V_B after a previous discharge depends upon the rates of deionization and cooling of the discharge path during the time of repose τ. The author obtained $V_B - \tau$ curves of TR-tubes by impulse voltage on a Braun-tube screen. He also made some numerical calculations and explained the characteristic feature of the $V_B - \tau$ curves as well as the breakdown process manifested therein. A.

537.521.6

1327. DEPENDENCE OF BREAKDOWN ON DARK CURRENT AND FREQUENCY. W.Fucks.
Appl. sci. Res. B, Vol. 5, No. 1-4, 109-23 (1955).

It is shown that a consistent theory of electrical breakdown in gases is impossible, unless a third independent variable, the dark current i_0, is introduced besides pressure p and electrode separation L. The root laws for the dependence of the breakdown potential on i_0 are discussed and compared with new experiments. Similarity arguments show, that a three-particle-impact mechanism seems to be of fundamental importance for the breakdown in H_2. Finally some new experimental results on a.c. breakdown potential measurements in uniform fields are published. A.

537.523

1328. ULTRA-HIGH-FREQUENCY BREAKDOWN IN IRRADIATED PARALLEL PLATE GAPS. W.A.Prowse and P.E.Lane.
Appl. sci. Res. B, Vol. 5, No. 1-4, 127-30 (1955). Also in: Rep. Brit. Elect. Res. Assoc., Rep. L/T343, 6 pp. (1956).

U.H.F. breakdown stresses were measured in air, oxygen, nitrogen and hydrogen at frequencies 0.85 Mc/s to 11.5 Mc/s. Mid-gap irradiation by a distant (15 cm) auxiliary spark in the same gas was used. The breakdown stresses were independent of gap length. When the irradiating spark was too close to the test gap, the breakdown stress fell slightly. A qualitative explanation is offered. A.

537.523

1329. THE SPREADING OF A DISCHARGE CHANNEL. A.S.Zingerman.
Zh. tekh. Fiz., Vol. 26, No. 5, 1015-20 (1956). In Russian.

Investigation of the spreading of discharge channels of lengths 1-10 μ for dissipated energies of 0.1-400 joules. With discharges of duration longer than 3×10^{-3} sec spreading occurred in all cases. Results are compared with those given by the hydrodynamic theory of Drabkina (Abstr. 6985/1951). For high energy dissipations, with consequent atomization or vaporization of the electrodes the coefficients in Drabkina's expression need to take account of the electrode material as well as the gas. It is shown experimentally that the diameter of the hole formed in an electrode as a result of the arc erosion, is equal to the diameter of the discharge channel. The paper gives a table of values of spreading coefficients for various electrodes and gas materials and arc lengths. C.R.S.Manders

537.523.4

1330. SOME PROPERTIES OF SPARK CHANNELS. J.D.Craggs.
Appl. sci. Res. B, Vol. 5, No. 1-4, 262-8 (1955).

A brief description is given of some of the physical characteristics, e.g., the discharge temperatures, of the transient arc (channel) stage of the spark discharge in hydrogen and helium. Reference is also made to measurements of ion densities in these gases. A.

537.523.4

1331. THE MECHANISM OF GROWTH OF SPARK DISCHARGES. J.M.Meek.
Appl. sci. Res. B, Vol. 5, No. 1-4, 269-76 (1955).

A brief review is given of experimental studies of the growth of spark discharges in non-uniform and in uniform fields. The observed characteristics are discussed in terms of both the Townsend and the streamer theories of the spark mechanism. A.

537.523.4 : 535.345

U.V. IRRADIATION OF SPARK GAPS. See Abstr. 1186

537.523.5

1332. THE THERMALLY EXCITED PLASMA IN THE COLUMN OF AN ELECTRIC ARC. W.Lochte-Holtgreven.
Appl. sci. Res. B, Vol. 5, No. 1-4, 182-8 (1955).

The emission of an electric arc at atmospheric pressure corresponds to thermal excitation. The concentration of electrons, the temperature and the composition of the luminous gas may accordingly be calculated, provided that one or a few measurements are made. In the case where the arc burns in an atmosphere containing hydrogen a simple estimate of the electron concentration may be obtained by counting the number of Balmer lines observable. This method may be applied equally well in case of higher electron densities and also for hydrogen-like series of other elements. The lines show Stark effects resulting from fluctuating microfields which have been measured and found to correspond to theory. A.

537.523.5

1333. THE POSITIVE COLUMN OF HIGH- AND LOW-CURRENT ARCS. L.A.King.
Appl. sci. Res. B, Vol. 5, No. 1-4, 189-95 (1955).

The central core temperatures and the radial temperature distributions have been calculated for arcs at different currents in nitrogen. Using Gaydon's value (9.76 eV) for the dissociation potential of N_2, good agreement is obtained between theory and observation, and the transition of the positive column at currents of about 50 amperes is explained by the effect of molecular dissociation on the thermal characteristics. A.

537.523.5 : 621.314.65

1334. APPLICATION OF MERCURY ARC THEORY TO THE DESIGN OF INDUSTRIAL RECTIFIERS. M.Hoyaux.
Appl. sci. Res. B, Vol. 5, No. 1-4, 253-8 (1955).

A new theory of the mercury arc has been developed which allows the calculation of some parameters of an industrial rectifier. It takes into account the following phenomena: gas ionization by electrons, electron extraction at the cathode spot by ionic bombardment, magnetic auto-striction and the scattering of electrons by Coulomb field of positive ions. Agreement with experiment is very good. A.

537.523.5 : 536.55

1335. ON THE MEASUREMENT OF CARBON ARC TEMPERATURES USING THE Mg EMISSION SPECTRUM. F.Hegemann and C.von Sybel.
Z. wiss. Photogr., Vol. 50 (II), No. 1-12, 463-75 (1955). In German.

Describes in detail the measurement of excitation temperatures of carbon arcs using Mg emission lines. The technique, and the calibrations required, are fully discussed. The temperatures ranged from about 4500 to 6000°K. Time variations, over about 2 minutes, were also studied. 20 refs. J.D.Craggs

537.523.5

1336. ARC INITIATION IN HYDROGEN. F.W.Crawford and H.Edels.
Brit. J. appl. Phys., Vol. 7, No. 10, 380 (Oct., 1956).

Describes briefly how arc initiation difficulties in pure (or oxygen-free) hydrogen may be overcome by a suitable pre-arc pulsing technique. J.D.Craggs

537.523.5

1337. THEORY OF THE LOW-VOLTAGE ARC REGION. A.V.Nedospasov.
Zh. tekh. Fiz., Vol. 26, No. 6, 1202-7 (1956). In Russian.

The study by Klyarfel'd et al. (Zh. tekh. Fiz., Vol. 17, 319, 1947) of the phenomena of the cathode region of an arc discharge is qualitative and incomplete. The present paper is concerned with a theoretical examination, on the assumption of diffusion conditions, of the problem of charge distribution in the region, the variation of potential along the tube axis,

and the dimensions of the region. Apparatus, with which the author's conclusions were checked, is described. Results appear to confirm the theory. The experiments themselves are complementary to those of Radionovskiĭ (Zh. tekh. Fiz., Vol. 23, 591, 1953). C.R.S.Manders

537.525

1338. PLASMA ELECTRON OSCILLATIONS. K.G.Emeleus.
Appl. sci. Res. B, Vol. 5, No. 1-4, 66-8 (1955).

After emerging from the cathode sheath of a low voltage arc at low pressure, the primary electrons excite and participate in an u.h.f. oscillation in the plasma. This attains large amplitude rather abruptly a few mm from the cathode. The present paper contains a concise description and brief commentary on discharges of this type and of their relation to some other forms of v.h.f. and lower frequency discharges. Most of the processes involved are probably markedly non-linear. The possibility of electrical turbulence is mentioned. A.

537.525

1339. HIGH FREQUENCY OSCILLATIONS IN LOW PRESSURE MERCURY ARCS. H.J.J.van Boort and M.Klerk.
Appl. sci. Res. B, Vol. 5, No. 1-4, 69-74 (1955).

The influence of the associated circuit of a low-pressure tubular fluorescent lamp on the propagation of the noise generated in the lamp is discussed. Two types of noise, cathode noise and anode noise, have been distinguished by the use of an electronic method. The cathode-noise is subjected to a more detailed investigation, particularly the re-ignition noise. A hypothesis is given as to the manner of generation of two different types of re-ignition noise. A.

537.525

1340. GAS DISCHARGE BREAKDOWN AS A FUNCTION OF FREQUENCY. M.T. Vlaardingerbroek.
Appl. sci. Res. B, Vol. 5, No. 1-4, 139-43 (1955).

Breakdown voltages of glow discharges in Ne and Ne-A mixtures as a function of the frequency are discussed. The variation of the breakdown voltage with rising frequency can be understood qualitatively from build-up times and the increase of pre-breakdown current caused by particles remaining from previous periods. A.

537.525

1341. ON THE ELECTRICAL DISCHARGE IN D.C. AND HIGH FREQUENCY FIELDS SIMULTANEOUSLY. K.Yamamoto and T.Okuda.
Appl. sci. Res. B, Vol. 5, No. 1-4, 144-7 (1955).

When a d.c. and a h.f. field are perpendicularly superposed in an electrical discharge ($p \sim 10\text{-}10^{-4}$ mm Hg), three types of discharge can exist, classified from the standpoint of d.c. conduction: (1) d.c. glow type, d.c.-dominant discharge with additional ionization by h.f. field; (2) space charge-limited type, the same as the conduction in the floating double probe in a plasma produced by h.f. field; (3) an intermediate stage between the first and second types, herein referred to as transition type. According to the authors' analysis of the transition type at low pressure, the value of γ in high electric fields can be deduced from the measurement. A.

537.525

1342. AN APPARATUS FOR STUDYING PERIODIC PLASMA. R.A.Ledrus.
Appl. sci. Res. B, Vol. 5, No. 1-4, 151-6 (1955).

The apparatus described permits Langmuir probe theory to be applied to the plasma of any periodic gas discharge. Examples of applications to the study of mercury arc rectifiers are given. A.

537.525

1343. THE WRIGGLING DISCHARGE IN FREE SPACE. S.J.Roberts, P.A.Sturrock, W.B.Thompson and R.T.P.Whipple.
Atomic Energy Res. Establ. (Harwell) Rep. No. T/R 1792, 26 pp. (1955).

An attempt is made to study the properties of a "wriggling" (i.e. unstable) discharge at low pressure by considering the forces acting on a simplified model — a thin extensible wire. These are calculated to a linear approximation for an arbitrary plane distortion and the discharge is shown to be unstable. For a sinusoidal distortion a formula for the force is calculated and shown to be proportional to the product of the displacement, curvature of the current channel, the square of current and the negative of the logarithm of the products of wave-number and wire radius. For the arbitrary plane distortion the first non-linear terms are of third order in the displacement, and the sinusoidal disturbance contains the third harmonic tending to distort the discharge into a more peaked configuration. The forces acting on a helical channel are calculated, and in certain circumstances are shown to produce maximum instability for a 45° pitch. Finally the forces on an isolated arc are investigated, and it is shown that the above-mentions formula is useful if the curvature is constant and if $\epsilon/a < 1/20$, where ϵ = radius of discharge, a = radius of curvature. A.

537.525

1344. SIMPLE WAY TO OBTAIN THE VELOCITY DISTRIBUTION OF THE ELECTRONS IN GAS DISCHARGE PLASMAS FROM PROBE CURVES. G.Medicus.
J. appl. Phys., Vol. 27, No. 10, 1242-8 (Oct., 1956).

Until now no simple technique of determining the velocity- or energy-distribution function of the electrons in gas discharge plasmas was known. Here a method of quickly finding this function from probe curves (preferably automatically plotted ones) is described. It is shown that for a given probe current—voltage curve J(U) the energy distribution function g(U) of the electrons is proportional to a simple function which may be graphically determined from J(U). This function is $U^{-1/2}\Delta J_0/\Delta U$, where ΔJ_0 is the distance between the intersections of the two tangents to the probe curve J(U) at the ends of the voltage interval ΔU with the current axis, and U is the (retarding) voltage in the middle of ΔU. It can be used for a determination of the energy distribution g(U) in a simple and straightforward one-step procedure which is faster and in practice more accurate than the two-step procedure previously used for finding g(U) by means of $\partial^2 J/\partial U^2$. A set of probe curves which stem from a Maxwellian distribution is evaluated in both the conventional and the new way. The electron temperatures obtained check excellently. A set of probe curves from strongly non-Maxwellian distributions in a Ne fireball discharge is evaluated. The presence of a fast and a slow group of electrons is revealed. The results are interpreted to some extent. Errors and dependability are discussed. A.

537.525

1345. EXPERIMENTAL STUDY OF IONIZED MATTER PROJECTED ACROSS A MAGNETIC FIELD. W.H.Bostick.
Phys. Rev., Vol. 104, No. 2, 292-9 (Oct. 15, 1956).

A plasma gun has been developed which projects ionized matter (metallic and deuterium ions) at speeds up to 2×10^7 cm sec^{-1}. There is some evidence to support the hypothesis that the plasma projected by this gun comes off in an expanding torus which is shaped by its own magnetic field. When the plasma gun is fired into a d.c. magnetic field, the plasma forms a compact geometrical configuration (a plasma-magnetic entity called a plasmoid) which proceeds across the magnetic field. Plasmoids appear to be plasma cylinders elongated in the direction of the magnetic field. Plasmoids possess a measurable magnetic moment, a measurable translational speed, a transverse electric field, and a measurable size. Plasmoids can interact with each other, seemingly by reflecting off one another. Their orbits can also be made to curve toward one another. Plasmoids can be made to spiral to a stop if projected into a gas at about 10^{-3} mm Hg pressure. Plasmoids can also be made to smash each other into fragments. There is some scant evidence to support the hypothesis that they undergo fission and possess spin. A.

537.525 : 533.332

RESONANCE RADIATION IN INERT-GAS DISCHARGES.
See Abstr. 1176

537.525.4 : 536.55

1346. GAS TEMPERATURE IN ARGON SPARK CHANNELS. R.D.Craig.
Rep. Brit. Elect. Res. Assoc., Rep. L/T318, 2 pp. (1954)

Gives preliminary data obtained in trial experiments to determine spark-channel gas temperatures. A.

537.525.5

1347. EXTERNALLY HEATED HOT CATHODE ARCS. E.O.Johnson.
Appl. sci. Res. B, Vol. 5, No. 1-4, 226-30 (1955).

The conduction path in a noble gas between an anode and a copiously emitting hot cathode consists of one, two, or more plasmas connected by sheaths and existing at different potentials. These different conducting modes, the conditions under which one changes into another, and other accompanying phenomena can be reasonably well described by simple models. A.

537.525.5

1348. POTENTIAL DISTRIBUTION IN MAGNETIC ARC DISCHARGES. J.Kistemaker.
Appl. sci. Res. B, Vol. 5, No. 1-4, 313-17 (1955).

Using a new hot probe technique, valuable information has been gathered about the potential distribution of the central arc column of a discharge with an axial magnetic field. Deep potential troughs have been found in case of electro-negative gases (O_2, Cl_2). In the oscillating electron type of discharge the troughs are much deeper, e.g. 90 V in case of an arc voltage of 100 V. The central plasma potentials for electro-positive gases (A, H_2, N_2) are still negative in comparison with the anode potential, which is in striking contrast with earlier investigations. The depth of the potential troughs has been investigated as a function of current, pressure and gas composition. A.

537.525.5

1349. DISCHARGE MECHANISM OF MERCURY POOL ARCS. K.G.Hernqvist.
J. appl. Phys., Vol. 27, No. 10, 1226-36 (Oct., 1956).

A model for the discharge mechanism of mercury pool arcs is proposed and shown to be in agreement with experiment. The conclusions drawn from this model are the following: (1) Mercury pool arcs operate in the ball of fire mode of discharge. (2) The electron emission mechanism is nonthermionic. Emitted electrons from the cathode arrive with only thermal energies in a plasma adjacent to the cathode. The potential of this plasma is equal to or slightly higher than that of the Fermi level of the cathode. The emission may be either due to a large electric field at the cathode surface (tunnel effect) or due to an effective lowering of the cathode work function. This lowering of the work function may be caused by a vapour or plasma of high density adjacent to the cathode surface. A.

537.525.5

1350. MOTION OF A SHORT ARC IN A MAGNETIC FIELD. A.E.Robson and A.von Engel.
Phys. Rev., Vol. 104, No. 1, 15-16 (Oct. 1, 1956).

When an electric arc with an evaporating cathode (e.g., copper) is exposed to a strong transverse magnetic field in atmospheric air, its motion can be made to change from the conventional to the reverse direction by reducing sufficiently the electrode separation. The effect is discussed in terms of an earlier idea based on the resultant magnetic field acting on the cathode region. This field is composed of the applied field and the "loop" field of the curved current path above the cathode spot. At low pressure, an increase of the former is accompanied by a rapid increase of the latter and thus the resultant field changes its sign. Here at high pressure and constant external field, the change of sign at small electrode separation is caused by a forced reduction of the radius of curvature of the deflected positive column. A.

537.529

1351. THE ELECTRIC STRENGTH AND SURFACE CONDITION OF THE ALKALI HALIDES. W.A.Smith.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 848-9 (Aug., 1956).

Sodium chloride crystals were ground to the recessed shape suitable for breakdown tests, polished, and then annealed to relieve internal strains. Annealing rendered the polished transparent surface translucent, and one group of 24 samples was tested in this condition. The results agreed closely with those of another group which had been repolished after annealing, showing that the condition of the surface was not important. K.W.Plessner

X-RAYS 537.531

537.531 : 535.34

1352. THE FINE STRUCTURE OF THE BASIC X-RAY K-ABSORPTION SPECTRUM OF TITANIUM IN CERTAIN DIELECTRIC MATERIALS. É.E.Vaĭnshteĭn, I.B.Staryĭ and M.N.Bril'.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 943-6 (1956). In Russian.

Using a bent quartz crystal vacuum spectrometer the X-ray absorption spectra of rutile, anatase, brookite, perovskite and ilmenite were recorded. The resolving power of the instrument was 2.5 X/mm and points 0.2 eV apart in the structure of the Ti absorption egde could be separated. The differences in the spectra are discussed qualitatively. A.L.Mackay

537.531

1353. NEED FOR UPWARD REVISION OF λ_g/λ_s AND ITS CONSEQUENCES. J.W.M.DuMond.
Phys. Rev., Vol. 103, No. 5, 1583-4 (Sept. 1, 1956).

The ratio of the X-unit to the milli-Angstrom needs revision of the order 30-40 parts per million. This is indicated both by absolute grating measurements and by the effect of the Lamb shift on calculations of optical wavelengths used in comparison measurements (Tyrén, Z. Phys., Vol. 109, 722, 1938). The effect of such a revision on the values of some of the fundamental physical constants is considered. A.R.Stokes

537.531 : 548.733

IMPROVED DEMOUNTABLE CRYSTALLOGRAPHIC ROTATING ANODE X-RAY TUBE. See Abstr. 874

537.531.08

1354. EXPERIMENTS IN THE PHOTOGRAPHIC MONITORING OF STRAY X-RAYS. I. GENERAL CONSIDERATIONS. THE CHOICE OF FILM CALIBRATING RADIATIONS IN ROENTGEN THERAPY AT 220 kVP AND 1000 kVP. R.B.Wilsey, D.H.Strangways and G.M.Corney.
Radiology, Vol. 66, No. 3, 408-17 (March, 1956).

A discussion is given of the film calibration procedures for monitoring of radiation hazard with attention to effects due to angular variation in the film sensitivity and to variation in quality of the stray radiation to be measured. It is concluded that for therapeutic installations enclosed completely in a protective barrier, at 250 kV the heavily filtered primary radiation or gamma-rays should be used for calibration. If scattered radiation from the patient predominates the normally filtered primary beam should be used. At 1000 kV any one of these three types of calibration radiation may be used. H.Miller

537.531.08

1355. EXPERIMENTS IN THE PHOTOGRAPHIC MONITORING OF STRAY X-RAYS. II. THE CHARACTERISTICS OF THE STRAY RADIATIONS, AND THE CHOICE OF FILM-CALIBRATING RADIATIONS IN DIAGNOSTIC RADIOLOGY. R.B.Wilsey, H.R.Splettstosser and D.H.Strangways.
Radiology, Vol.66, No. 3, 418-28 (March, 1956).

Using water phantoms the quality of the scattered radiation from a 70 kVP X-ray beam in various directions is investigated. The primary radiation is assumed adequate for purposes of calibrating monitoring films. A similar conclusion holds for scattered radiation in screening procedures. The structure of the walls of the X-ray room to give minimum intensity of scattered radiation is examined in detail. H.Miller

CATHODE RAYS.

POSITIVE RAYS 537.533/.534

537.533

1356. THE MOTION OF ELECTRONS IN CYCLIC ACCELERATORS AS A STOCHASTIC PROCESS. A.N.Matveev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 495-8 (1956). In Russian.

In some previous work betatron and synchrotron oscillations occurring in strong-focusing electron synchrotrons have been studied by classical methods. These oscillations are of semi-classical nature, owing to the fact that their excitation arises from a discrete number of emission acts. In view of the mathematical difficulties involved, the method cannot be generalized to the case of an arbitrarily varying magnetic field. A hint to a more general approach is found by considering that the radiation is mainly due to the cyclic motion of the electrons, and not to betatron and synchrotron oscillations (radiative acts occur independently of the phase of the oscillations). The phenomenon as a whole may therefore be regarded as a stochastic process. Two differential stochastic equations, describing betatron and synchrotron oscillations induced by radiation, are written down and the distribution function of the electrons (in x and t) is found in a form of a very rapidly convergent series. In this calculation the absorption of the walls of the vacuum chamber is taken into account. Results are discussed with reference to various possible cases and compared with the results obtained by other authors. G.Martelli

537.533

1357. PROBLEMS OF ADJUSTMENT AND CALIBRATION OF A 31.8 MeV BETATRON. G.Boulégue and P.Chanson.
J. Phys. Radium, Vol. 17, No. 7, 596-7 (July, 1956). In French.

The betatron is calibrated: as regards energy, with reference to known nuclear thresholds; as regards intensity, by the following methods: activation of copper; ionization in a lucite block; or neutron yield of an irradiated sample. A.

537.533

1358. A 2.3 MeV LINEAR ELECTRON ACCELERATOR. T.Frelot, R.Combe and M.Feix.
J. Phys. Radium, Vol. 17, No. 7, 598-9 (July, 1956). In French.

A travelling-wave accelerator is briefly described. The results obtained with the apparatus are presented. Some information about waveguide, microwave circuit, electron gun, and focusing coils, is given. A.

537.533

1359. THE LINEAR ELECTRON ACCELERATOR OF THE C.E.N. DE SACLAY. E.Picard.
J. Phys. Radium, Vol. 17, No. 7, 600-1 (July, 1956). In French.

The main characteristics of the beam are a mean current 85 μA for an energy of 28 MeV, and a duty cycle of 1/1000. The beam, when falling on an uranium-target, creates a mean flux of 10^{13} neutrons per second. An accurate magnetic deflection provides a monochromatic electron beam, the relative spread of which will be of the order of 10^{-3}. The experimental facilities are described. A.

537.533

1360. BEAM EXTRACTION IN THE MICROTRON. E.Brannen and H.I.S.Ferguson.
Rev. sci. Instrum., Vol. 27, No. 10, 833-4 (Oct., 1956).

Describes the utilization of a simple universal vacuum joint, as the support for a magnetic shield type of deflector in the form of a cylindrical soft iron pipe. Variable insertion of this pipe and change of direction in azimuth permit the extraction, with up to 70% efficiency, of all the microtron orbits, making available, in this case, electrons between 1 and 4 MeV energy, in steps of 0.5 MeV. Radiation intensity, or electron current, from any particular orbit, up to the limit determined by the peak for that orbit, may be set at any desired level by small changes in the insertion of the deflector. A.

537.533.2

1361. HIGHER-ORDER CORRECTIONS TO THE FIELD EMISSION CURRENT FORMULA. P.H.Cutler and R.H.Good, Jr.
Phys. Rev., Vol. 104, No. 2, 308 (Oct. 15, 1956).

In this paper, higher-order terms in expansions made to obtain the field emission current formula are retained. Analytic expressions for first-order correction terms to the current formula are derived. A.

537.533.3 : 537.534.3 : 621.385.833

1362. NEW PHYSICO-ENGINEERING METHODS OF MODELLING AND CALCULATION OF THE TRAJECTORIES OF RELATIVISTIC CHARGED PARTICLES IN ELECTROSTATIC FIELDS. A.M.Strashkevich.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 440-3 (1956). In Russian.

Brief reference is first made to those approximate methods of calculation involving representation by a gravitational field. It is then shown that by suitably modifying the potential distribution function these methods can be applied to relativistic particles. For a typical case calculations are made by four methods, one of them being strictly accurate. The method proposed yields results of accuracy sufficient for most practical purposes. S.C.Dunn

537.533.3

1363. ON THE EFFECT OF THE TRANSITION REGION UPON AN ELECTRON BEAM CONSTRAINED BY BRILLOUIN FLOW. B.W.Manley.
J. Electronics, Vol. 2, No. 3, 241-6 (Nov., 1956).

The introductory conditions of an electron beam into an axial magnetic field are derived. Design conditions for a useful range of beam parameters are given. A.

537.533.3

1364. THE CHANGE IN SCATTERING POWER OF ELECTRON MICROSCOPICAL SPECIMENS UNDER ELECTRON BOMBARDMENT. F.Lenz and W.Scheffels.
Z. Naturforsch., Vol. 11a, No. 8, 656-62 (Aug., 1956). In German.

Contrast can be observed in the electron image of a thin film in which there are neither variations in thickness nor differences in chemical composition. The film is placed near the back focal plane of a strong electron lens wide of aperture. The marginal portion of the illuminating beam creates a caustic, of form determined by the lens aberrations, across which the current density varies by several orders of magnitude. The central part of the beam throws a shadow image of the film on to a viewing screen, and variations in contrast are seen in the regions where the current density is high, i.e. an image is formed of the cross-section of the caustic in the plane of the film. The origin of this contrast is shown to lie in reversible changes in the properties of the specimen under electron bombardment. A theory of image formation due to Uyeda (Abstr. 5443/1955), with approximations for the mean inner potential due to Bethe, is used to give a quantitative explanation of the change in contrast. It postulates that ionization and excitation of some of the atoms in the specimen lead to an increase in the coherent and incoherent scattering, the visible effect being an enhanced phase contrast. V.E.Cosslett

537.533.332

1365. SOME ANTISYMMETRICAL MAGNETIC FIELDS WITH DOUBLE FOCUSING. I. Yu.V.Vandakurov.
Zh. tekh. Fiz., Vol. 25, No. 14, 2545-55 (1955). In Russian.

The fields whose scalar magnetic potential is antisymmetrical in relation to a certain median plane are generated by the N and S poles arranged symmetrically to this plane. An expression is obtained for the antisymmetrical magnetic field with rotation symmetry, characterized by the double focusing of the paraxial beam of charged particles. The nature of the field depends on the direction and the initial radius of curvature of the axial beam path. The position of the image, magnification, dispersion and aberration are calculated for some values of the parameters referred to above. The possibility is also investigated of effecting double focusing in antisymmetrical fields which do not depend on one of the Cartesian coordinates. F.Lachman

537.533.332

1366. SOME ANTISYMMETRICAL MAGNETIC FIELDS WITH DOUBLE FOCUSING. II. Yu.V.Vandakurov.
Zh. tekh. Fiz., Vol. 26, No. 7, 1599-610 (1956). In Russian.

For Pt I see preceding abstract. Discusses the focusing properties of the antisymmetrical magnetic fields with rotation symmetry for the case when the basic trajectory of the beam, positioned in the median plane of the field, is, at its initial point, perpendicular to the radius. Fields with double focusing are studied in which several intermediate images, obtained as a result of focusing in only one (horizontal or vertical) direction, are found between the source and the final image. It is shown that in some fields of this type the dispersion is strong and that no aberration of the second order, which depends on the angle of the beam in the median plane, is found. F.Lachman

537.533.35

1367. ELECTROSTATIC HIGH VOLTAGE GENERATOR ON THE ELECTRON MICROSCOPE. W.Herchenbach and H.Düker.
Optik, Vol. 13, No. 8, 375-6 (1956). In German.

A commercial electrostatic generator with an output of 750 μA was connected to an electrostatic electron microscope. The variation in H.T. voltage was about 1%. A resolving power of about 50 A was obtained. Diffraction patterns were also obtained. A.E.I. Research Laboratory

537.533.35 : 539.166.83

1368. RESEARCH ON LOW-ENERGY ELECTRONS EMITTED BY RADIOACTIVE SUBSTANCES. J.B.Bellicard and A.Moussa.
J. Phys. Radium, Vol. 17, No. 7, 532-3 (July, 1956). In French.

Description of the improvements effected in the ironfree double-focusing spectrometer previously described (Abstr. 324/1955), in order to study low-energy electrons: Improvements in the vacuum system; compensation of the earth field.

Presentation of the results obtained with this apparatus: Auger-K (Zn^{65}, Co^{57}) and Auger-L (Th B + C) spectra. Conversion electrons of Co^{57}. A.

537.533.35

1369. ABERRATION OF A CIRCULAR SOURCE IN A β SPECTROMETER WITH UNIFORM AXIAL FIELD. L.Dick.
J. Phys. Radium, Vol. 17, No. 7, 590-1 (July, 1956). In French.

From the shape of the line obtained with an eccentric point source in an axial constant-field β spectrometer, the shape of the line obtained with a circular source can be calculated. A.

537.533.35

1370. USE OF A RING SOURCE IN A HOMOGENEOUS FIELD RING FOCUSING BETA-RAY SPECTROMETER.
J.A.Jungerman and D.B.Beard.
Rev. sci. Instrum., Vol. 27, No. 1, 56-7 (Jan., 1956).

537.533.35

1371. USE OF A RING SOURCE IN A HOMOGENEOUS FIELD RING FOCUSING BETA-RAY SPECTROMETER. II.
J.A.Jungerman and D.B.Beard.
Rev. sci. Instrum., Vol. 27, No. 8, 650 (Aug., 1956)

A correction to the theory (preceding abstract) of the performance of a β-ray spectrometer having a ring source in a homogeneous magnetic field. D.R.Chick

537.533.73

1372. ELECTRON DIFFRACTION CAMERA OF A SIMPLIFIED DESIGN. M.A.Rumsh.
Zh. tekh. Fiz., Vol. 25, No. 14, 2556-64 (1956). In Russian.

Describes a simple electron diffraction camera in which the electron beam is obtained by double focusing; the part of the first magnetic lens with a short focal length is played by an electrostatic lens generated in the cathode-diaphragm area when a negative (with regard to the filament) potential is applied to the diaphragm. Rubber is used as gasket material in the cathode unit. The following units of the apparatus are illustrated and described in detail: cathode part with anode diaphragm, collimator part, diffraction chamber, and photographic camera. Electron diffraction photographs of NaCl and MgO, obtained with this apparatus are illustrated. The mean $r/\Delta r$ ratio for the NaCl photograph is 350. The (220) quadruplet of MgO has not been resolved, which is explained by the scattering property of the MgO preparation. F.Lachman

537.533.74

1373. DISTRIBUTION OF ELECTRONS SCATTERED BY SOLIDS.
J.A.Simpson, T.F.McCraw and L.Marton.
Phys. Rev., Vol. 104, No. 1, 64-7 (Oct. 1, 1956).

The distribution in energy and angle of 20 keV electrons scattered by thin foils of representative substances has been measured. The resolution is better than 0.1% in energy and 10^{-3} radian in angle. Data are presented for C, Al, Ni, Au of varying thicknesses, Formvar, and Al_2O_3. The effects of beam collimation and initial beam "contamination" on the angular distribution of a Cu single crystal are demonstrated. A.

537.533.74 : 539.152.1

1374. THEORY OF INELASTIC ELECTRON SCATTERING BY THE C^{12} NUCLEUS. R.A.Ferrell and W.M.Visscher.
Phys. Rev., Vol. 104, No. 2, 475-8 (Oct. 15, 1956).

The recently measured elastic and inelastic electron scattering cross-sections of C^{12} are utilized to test the shell model of light nuclei. Collective effects are important in the excitation of two of the excited states (7.68 and 4.42 MeV), and are acceptably accounted for by the independent-particle approach to collective oscillations recently proposed by the authors. The inelastic scattering data leading to the 9.61 MeV state are shown to identify it as probably 1^-. Some of the results of higher energy scattering experiments on C^{12} and O^{16} are predicted. A.

537.533.74

1375. APPLICATION OF VARIATIONAL METHODS TO THE THEORY OF THE SCATTERING OF SLOW ELECTRONS BY HYDROGEN MOLECULES. H.S.W.Massey and R.O.Ridley.
Proc. Phys. Soc. A, Vol. 69, Pt 9, 659-67 (Sept., 1956).

The cross-section for the elastic scattering of slow electrons by molecular hydrogen is calculated by use of the variational methods of Hulthén and of Kohn, full allowance being made for electron exchange. The trial wave-function is assumed to have a form which in spheroidal coordinates resembles the analogous functions in spherical polar coordinates used in discussing elastic scattering by hydrogen and helium atoms. Quite good agreement is obtained with observed data — an agreement which disappears when exchange is neglected; this is a situation similar to that which arises in the case of helium. A.

537.533.74

1376. CALCULATION OF THE ELASTIC SCATTERING OF SLOW ELECTRONS BY HYDROGEN ATOMS BY THE METHOD OF INTEGRAL EQUATIONS. V.I.Ochkur and Yu.V.Petrov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 146-8 (1956). In Russian.

The results obtained in this way are compared with the results from the variational approach and from numerical integration. G.E.Brown

537.533.8

1377. PREPARATION AND PROPERTIES OF THIN FILM MgO SECONDARY EMITTERS. P.Wargo, B.V.Haxby and W.G.Shepherd.
J. appl. Phys., Vol. 27, No. 11, 1311-16 (Nov., 1956).

Some simple methods of preparing MgO thin films on Mg—Ag alloy with high secondary emission ratios are discussed. The oxidation procedure and a discussion of the underlying phenomena are presented. Films with a secondary yield of 12 at 600 V may be produced by oxidation in either oxygen or carbon dioxide. Results of a study of some of the factors influencing the life of a secondary emitter are given. These include the effects on the secondary emitting characteristics of evaporation products from an oxide-coated cathode and the deterioration of the thin film under electron bombardment. A.

537.533.8

1378. ENERGY SPECTRA OF SECONDARY ELECTRONS FROM Mo AND W FOR LOW PRIMARY ENERGIES. G.A.Harrower.
Phys. Rev., Vol. 104, No. 1, 51-5 (Oct. 1, 1956).

Measurements have been made of the energy spectra of secondary electrons from molybdenum and tungsten using primary voltages, V_p, from 0 to 100 V. A 127° electrostatic analyser was used having an experimentally determined resolution of 1%. Primary electrons were decelerated to the required energy while approaching the target. The target was cleaned before each measurement by heating above 2000°K for one second. Measurement of the energy spectrum could be completed before formation of the first monolayer of contamination on the target surface. For V_p above 20 V, the observed energy spectra, each consisting of a low-energy maximum and a peak of elastically reflected primary electrons, were almost independent of V_p. For V_p below 20 V, the low-energy maximum became increasingly smaller and narrower and moved upward in energy by approximately 2 V. For V_p below about 5 V, reflected primaries remained but secondaries were absent. Similar but not identical results were obtained for molybdenum and tungsten targets. A.

537.533.8 : 535.14

1379. ANGULAR DISTRIBUTION IN ELECTRON—PHOTON SHOWERS WITHOUT THE LANDAU APPROXIMATION.
B.A.Chartres and H.Messel.
Phys. Rev., Vol. 104, No. 2, 517-25 (Oct. 15, 1956).

The track-length angular distribution of electrons in an electron—photon cascade is calculated without the use of the Landau approximation which was invariably used in all previous work. The Tamm—Belenky model of the cascade is used. The results are presented in the form of a series, the first term of which is of the same form as the result yielded by the Landau approximation but with a modified value of the parameter E_s. It is shown that the use of the Landau approximation introduces large errors not only for large values of the argument but for small values as well. The bearing of this result on previous theoretical work on the lateral distribution function is discussed. A.

537.533.8 : 537.312.5

SECONDARY AND PHOTOEMISSION FROM Mg AND Al. See Abstr. 1309

537.534

1380. ON THE THEORY OF ALTERNATING FOCUSING.
É.L.Burshteĭn and L.S.Solov'ev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 721-4 (1956). In Russian.

An investigation of the mathematical aspects of the equations of a strong focusing synchrotron, when the focusing conditions depend on parameters slowly changing with the time. G.Martelli

537.534

1381. RECENT IMPROVEMENTS MADE TO THE 2 MeV VAN DE GRAAFF OF THE ECOLE POLYTECHNIQUE. R.Barjon and J.Schmouker.
J. Phys. Radium, Vol. 17, No. 7, 594-5 (July, 1956). In French.

The improvements include: r.f. ion source, stabilization of the high-voltage electrode, absolute electrostatic analyser, regulated high-voltage r.f. power supply, focusing etc. These were made in order to improve the precision, stability and operation of this machine. A brief description is given of the first experimental results obtained. A.

537.534

1382. FIXED-FIELD ALTERNATING-GRADIENT PARTICLE ACCELERATORS. K.R.Symon, D.W.Kerst, L.W.Jones, L.J.Laslett and K.M.Terwilliger.
Phys. Rev., Vol. 103, No. 6, 1837-59 (Sept. 15, 1956).

It is possible, by using alternating-gradient focusing, to design circular accelerators with magnetic guide fields which are constant in time, and which can accommodate stable orbits at all energies from injection to output energy. Such accelerators are in some respects simpler to construct and operate, and moreover, they show promise of greater output currents than conventional synchrotrons and synchrocylotrons. Two important types of magnetic field patterns are described, the radial-sector and spiral-sector patterns, the former being easier to understand and simpler to construct, the latter resulting in a much smaller accelerator for a given energy. A theory of orbits in fixed-field alternating-gradient accelerators have been worked out in linear approximation, which yields approximate general relationships between machine parameters, as well as more accurate formulas which can be used for design purposes. There are promising applications of these principles to the design of fixed-field synchrotrons, betatrons, and high-energy cyclotrons. A.

537.534

1383. MODES OF ACCELERATION OF IONS IN A THREE-DEE CYCLOTRON. M.Jakobson, M.Heusinkveld and L.Ruby.
Phys. Rev., Vol. 104, No. 2, 362-5 (Oct. 15, 1956).

Formulae are presented for the maximum energy gain per turn of ions in a fixed-frequency cyclotron with three identical dees symmetrically spaced. Calculations have been made for dees of general angle θ and specific angles 60^0, 90^0, and 120^0. Dee excitations in which the dee voltages are all in phase or phased at 120^0 with respect to each other have been considered. The type of ions that can be accelerated is dependent upon the mode of excitation. In a 60^0 three-dee cyclotron with variable r.f. phasing, protons, deuterons, and tritons can be accelerated in the nonrelativistic energy region at substantially the same magnetic field and oscillator frequency. A 20 in. cyclotron of this type has been operated successfully. A.

537.534

1384. ON THE ROLE OF RADIATIVE LOSSES IN ORBITAL ACCELERATORS. A.A.Kolomenskiĭ and A.N.Lebedev.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1161-2 (1956). In Russian.

A generalization of the results published in previous papers (see Abstr. 8229-30/1956), on the damping effect of radiative losses on the betatron oscillations of electrons in orbital accelerators. G.Martelli

537.534

1385. FOCUSING SYSTEM OF AN ION ACCELERATING TUBE. Yu.A.Lapitskiĭ, I.I.Levintov, I.N.Slivkov and V.N.Shamshev.
Zh. tekh. Fiz., Vol. 26, No. 4, 733-9 (1956). In Russian.

The work on improving the focusing properties of a 1 MeV ion accelerator is reported together with a summary of the theory and detailed drawings. The new system will allow a fine regulation both of the cross-section of the beam, and of the beam current (up to 800 μA steady current and up to 2 mA with 1 μsec pulses). It is possible to vary, within large limits, the angle from which particles are injected from the focusing section into the accelerating sections, so it seems likely that the device could be easily fitted to other accelerators. G.Martelli

537.534.3

1386. A NOTE ON THE EFFECT OF THE RESIDUAL GAS PRESSURE UPON THE SPACING OF MASS SPECTROSCOPIC DOUBLETS. N.R.Isenor, G.R.Bainbridge, P.C.Eastman and H.E.Duckworth.
Canad. J. Phys., Vol. 34, No. 9, 993-5 (Sept., 1956).

C_3H_6O – Ni^{58} and $\frac{1}{2}Xe^{132}$ – Zn^{66} doublets were photographed at different pressures in a Dempster-type double-focusing instrument, using an accelerating voltage of 15 000 V. The evidence indicates that the former doublet spacing decreases with increasing pressure at a rate of 0.035 m.m.u. per 10^{-6} mm Hg, in the range 5-60 x 10^{-6} mm Hg. Within experimental accuracy, the latter spacing was not markedly pressure dependent. Further investigation is contemplated. N.M.King

537.534.3 : 539.155.4

1387. THE MASS SPECTROMETRY OF THE ACTINIDE ELEMENTS. G.R.Hall and A.J.Walter.
Canad. J. Chem., Vol. 34, No. 3, 246-52 (March, 1956).

The problems involved in the mass spectrometry of the actinide elements and, in particular, the advantages of using a thermal ionization filament source are discussed. The relative behaviour of each of the actinide elements from thorium to americium using this source is described and the results are considered with reference to the Saha equation. A.

537.534.3

1388. ACCURATE MATHEMATICAL TREATMENT OF THE ANALYZER OF THE R.F. MASS SPECTROMETER TUBE. W.W.Cannon and M.K.Testerman.
J. appl. Phys., Vol. 27, No. 11, 1283-6 (Nov., 1956).

A mathematical treatment of the Bennett-type r.f. mass spectrometer has been developed which is appreciably simpler to handle when dealing with a multistage analyser. This simplification is a result of changing the point of reference in the tube from that previously used. The resulting form of the equation is soluble by the use of a very simple analogue computer which is described. A.

537.534.3

1389. INFLUENCE OF MAGNETIC AND ELECTRIC FIELD DISTRIBUTION ON THE OPERATION OF THE OMEGATRON. W.M.Brubaker and G.D.Perkins.
Rev. sci. Instrum., Vol. 27, No. 9, 720-5 (Sept., 1956).

The operation of an omegatron is discussed with polyphase electric excitation. Use is then made of this analysis to investigate the ionic trajectories in an omegatron in which the natural frequency of the ion is a function of the orbital radius. This circumstance comes about from either the influence of space charge or from the use of a magnetic field which decreases with increasing radius. The nonuniform magnetic field and the radial electric field can enhance the resolving power. It also influences the peak shape, causing the sides to be nearly vertical. Trapping of the ions is essential for satisfactory operation of the omegatron. Two experimentally proven means of accomplishing trapping are presented. A.

537.534.3

1390. THERMAL TRANSPIRATION IN THE MASS SPECTROMETER INLET SYSTEM. L.A.Dietz.
Rev. sci. Instrum., Vol. 27, No. 10, 817-18 (Oct., 1956).

Transpiration of gas in the inlet tube between the sample reservoir and the ion source is eliminated if the thermal gradient occurs in the low-pressure region between the leak and the ion source. Since transpiration was found to be a total pressure effect, sensitivity response is not affected if gas mixtures and calibrating gases are run at the same pressure, even though transpiration is present. A.

537.534.74

1391. ON THE THEORY OF PROTON–PROTON SCATTERING AT HIGH ENERGY. D.Geissler.
Ann. Phys. (Leipzig), Vol. 18, No. 3-4, 125-45 (1956). In German.

The S-, P- and D-phase-shifts are calculated on the hypothesis of a proton isomer with the assumption that the incident proton is distinguishable from the struck proton even before scattering. Three different potentials are considered and Coulomb effects included. The experiments in the 100-450 MeV range can be described by a deep square-well of the Serber type. P.T.Matthews

537.534.74 : 539.185

1392. SCATTERING OF POLARIZED NUCLEONS BY NUCLEI. F.C.Barker.
Atomic Energy Res. Establ. (Harwell) Rep. No. T/R 1791, 22 pp. (1956).

Formulae for calculating the asymmetry in scattering of high-energy polarized nucleons by nuclei are given, and the validity and utility of approximate methods of calculation are discussed. A.

537.534.74

1393. SCATTERING OF ALPHA PARTICLES FROM HELIUM. J.L.Russell,Jr, G.C.Phillips and C.W.Reich.
Phys. Rev., Vol. 104, No. 1, 135-42 (Oct. 1, 1956).

Excitation curves and angular distributions for the scattering of

α-particles from helium have been obtained for bombarding energies of 3 to 6 MeV, using a differentially pumped gas scattering chamber and a singly charged α-particle beam from a Van de Graaff accelerator. A phase-shift analysis of the data, yielding phase shifts accurate to about 2^0, reveals that only S- and D-wave scattering occurs and shows that the well-known excited state at 2.9 MeV in Be^8 is a D state. The scattering data taken at the Department of Terrestrial Magnetism and the Universities of Illinois and Indiana are compared to the present (Rice Institute) data by using the dispersion theory and the Landau K function formalism developed for proton–proton scattering. The dispersion theory, applied to the Rice data, allows a rough estimate of the D-state level parameters, while the K function, applied to the Rice and D.T.M. data, is used to deduce a ground state width for Be^8 of 4.5 ± 3 eV (c.m.). For excitation energies below 12 MeV, the scattering data are consistent with a description of the Be^8 nucleus as an interaction of two α-particles. Certain qualitative features of the potential of interaction of such a two-body configuration are discussed. A.

537.534.74

1394. p–p SCATTERING IN THE BeV RANGE. W.Rarita.
Phys. Rev., Vol. 104, No. 1, 221-4 (Oct. 1, 1956).

Some general methods of attacking the p-p scattering problem in the BeV range are outlined. A fairly definitive phase shift analysis can be made if the orbital quantum number is limited to three and if j independence is assumed. For the 1 BeV case, the inequality $\sigma(0^0) \geq (k\sigma_t/4\pi)^2$ (the minimum theorem) plays an essential role and facilitates the calculation. The phase shifts are found to depend on a single finite parameter. Detailed results are tabulated. The ray optical theory and the complex square-well potential are investigated and shown to be generally inadequate to describe the calculated phase shifts. A square-well potential with a central core suggests itself as a possible successful model. A.

537.534.74

1395. EFFECT OF PROTON–PROTON SCATTERING ON AN INITIAL LONGITUDINAL SPIN POLARIZATION. J.E.Simmons.
Phys. Rev., Vol. 104, No. 2, 416-18 (Oct. 15, 1956).

The Wolfenstein A parameter for proton–proton scattering is measured by three angles at an incident laboratory energy of 316 MeV. A.

537.534.74 : 539.185

1396. THE INELASTIC SCATTERING OF NUCLEONS BY THE SURFACE INTERACTION. S.Yoshida.
Proc. Phys. Soc. A, Vol. 69, Pt 9, 668-85 (Sept., 1956).

The effect of the surface interaction, based on A.Bohr's collective model, on the inelastic scattering of nucleons by a nucleus at medium energy is discussed. The wave function is expressed as a sum of amplitudes, which correspond to various states of target nucleus and incident nucleon. From the Schrödinger equation one can derive a set of coupled equations for the amplitudes, which correspond to a state of the surface excitation while the effect of the other amplitudes is replaced by distorting potentials. The interaction between the states considered explicitly is assumed as the surface interaction proposed by A.Bohr, and taken to have a δ-function type radial dependence. The coupled equations are solved without further approximation. The distorting potential is chosen so as to give the right result for the elastic scattering in the presence of the surface interaction. If that interaction is strong enough, the distorting potential differs considerably from the usual optical potential, which would give a good result for the elastic scattering in the absence of surface interaction. The theory is applied to proton scattering by Mg^{24} at 10 MeV, and the result shows that the strong angular dependence of the inelastic scattering is due to the surface interaction while the main contribution comes from the compound nucleus. A.

537.534.74

1397. PROTON–PROTON INTERACTIONS AT 650 MeV.
A.P.Batson and L.Riddiford.
Proc. Roy Soc. A, Vol. 236, 175-85 (Oct. 9, 1956).

Protons of mean energy 650 MeV from the Birmingham proton synchrotron have been passed through a hydrogen-filled diffusion cloud chamber located in a pulsed magnetic field, and a total of 317 interactions observed. Of these, 205 were elastic collisions and the remaining 112 involved the production of π^+- and π^0-mesons in the ratio 4.3 to 1. The elastic/inelastic ratio and the π^+/π^0 ratio agree with those obtained elsewhere; so also does the angular distribution of the elastically scattered protons, though the present experiment includes angles smaller than those covered in previous work. The elastic scattering is discussed in terms of the optical model of the nucleus and involves a radius of interaction of about 0.8×10^{-13} cm. Of events of the type $p + p \rightarrow n + p + \pi^+$, 53 were analysed in detail and strong correlations were found between the directions of the proton and the meson, and of the proton and the neutron. These correlations, and the π^+/π^0 ratio, are consistent with an hypothesis due to Peaslee that at high energies such reactions proceed through an intermediate state of isotopic spin $I = \frac{3}{2}$, involving the formation of an "excited nucleon" which subsequently decays into a proton and a π^+-meson. The Q-value distributions for pairs of secondary particles in the above reaction also support this hypothesis. A.

537.534.74 : 539.18

PROTON–PION SCATTERING. See Abstr. 1647

537.534.75 : 778.34

1398. RANGE–ENERGY RELATIONS OF HEAVY IONS IN NUCLEAR EMULSIONS. A.Papineau.
J. Phys. Radium, Vol. 17, No. 7, 566-7 (July, 1956). In French.

Range–energy relations were calculated for heavy ions from lithium to neon, in nuclear emulsions, using the experimental curve for protons and the experimental determinations already known of the state of ionization of nitrogen, oxygen and neon ions v. energy. Some extrapolations were made for the probability of stripping of the last K electron. Curves so obtained are in good concordance with experimental points known for Li^8, B^8, C^{12}, N^{14}. A.

DISCHARGE TUBES. COUNTERS 537.54

537.542

1399. THE ENERGY SPECTRUM OF THE ION BEAM OF A HIGH FREQUENCY ION SOURCE. J.Erö.
Acta phys. Hungar., Vol. 5, No. 4, 391-407 (1956). In German.

The energy distribution of ions from a h.f. source, using a cathode assembly similar to that described by Moak et al. (Nucleonics, Vol. 9, 3, 1951) was analysed by means of an electrostatic deflection method. It was shown that the energy spread (~200 eV) was much greater than that to be expected from a theoretical analysis based on probe theory. This large spread was caused by breakdown occurring at the cathode surface, and was reduced (to about 50 eV) by re-design of the cathode assembly and purification of the cathode surface. The mean energy of the beam for one discharge tube used was found to be 50-100 V greater than the extraction voltage. J.Dutton

537.542

1400. GEIGER-COUNTER OPERATION WITHOUT DEAD-TIME. T.J.Lewis.
Appl. sci. Res. B, Vol. 5, No. 1-4, 305-8 (1955).

The dead time τ of a Geiger counter can be completely overcome by operating the counter with a pulsed voltage. The theory of the method is developed for two modes of measurement and simple formulae are derived. Even with $\tau = 100$ μsec, accurate counting is possible when the rate of arrival of particles at the counter is as high as 10^6/sec. A.

537.542

1401. DOUBLE PULSES IN RARE GAS–HALOGEN GEIGER COUNTERS. D.van Zoonen.
Appl. sci. Res. B, Vol. 5, No. 5, 368-86 (1956).

Above a certain potential across the counter the strongly differentiated pulses in most types of rare gas–halogen counters prove to be double pulses. The time difference between the two maxima is of the order of some microseconds. The over-voltage at which double pulses start to appear depends on the halogen pressure and on the radii of cathode and anode. Experiments with a photomultiplier and a diaphragm show that the photons of the first maximum originate in the vicinity of the wire, those of the second maximum in a channel between the cathode and the ion sheath of the first pulse. When double pulses occur, these counters are not self-quenching, but the multiplication in the second pulse continues until the potential across the counter is reduced to about the starting potential. In the double pulse region the charge developed in a pulse, the length of the plateau and the length of the dead time are dependent on the parallel capacity and the series resistance of the counter. The appearance of double pulses is attributed to field distortion by the space charge. In the first phase of a double

pulse this distortion hampers the multiplication, whereas in the second phase this distortion appears to increase the multiplication. Most types of commercially produced rare gas—halogen counters have their working potential in the double pulse region. A.

537.542

1402. RECENT DEVELOPMENTS IN LOW BACKGROUND GEIGER-MÜLLER COUNTERS. W.E.Grummitt, R.M.Brown, A.J.Cruikshank and I.L.Fowler.
Canad. J. Chem., Vol. 34, No. 3, 206-13 (March, 1956).

G.M. counting assemblies have been constructed which give dependable low background operation in routine use. Possible construction materials have been examined in detail for radioactive content in an effort to achieve minimum inherent activity in the assembly. The cosmic-ray component of the normal background has been eliminated by an anticoincidence arrangement. Increased reliability of the system is obtained through (a) use of a multiple anode anticoincidence counter in place of a bundle of tubes, (b) use of an electronic quench on both sample and shielding counters, and (c) operation of the assembly as flow counters in tandem. In the best arrangement to date a copper counter with a polystryrene seal gives a background of 0.9 counts per minute. A.

537.542

1403. STUDY, WITH A PHOTOMULTIPLIER, OF LUMINOUS IMPULSES PRODUCED IN THE GAS OF A PROPORTIONAL COUNTER. G.Charpak and G.A.Renard.
J. Phys. Radium, Vol. 17, No. 7, 585-6 (July, 1956). In French.

The light emitted by the atoms excited during a discharge in a proportional counter has been studied with a photomultiplier with a 1 in. diameter photocathode. The authors report preliminary results with mixtures of argon—propane and krypton—propane as filling gases. Checking the counter with 5.9 keV and 9.2 keV X-rays shows: (1) That the light is emitted by excited states of half-life close to 2×10^{-7} seconds; (2) That the intensity of light is proportional to the energy of the X-rays when the counter is working in the proportional region. In the experimental conditions described, the lower limit for the energy of the X-rays detectable by this method is 1 keV. This can be improved in particular by better geometry. A.

537.542

1404. THE WALL EFFECT IN IONIZATION CHAMBERS. P.Vittozzi.
Ann. Geofis., Vol. 9, No. 2, 195-9 (April,1956). In Italian.

The theoretical formulae for the effect in chambers for radioactivity measurements are deduced, taking into consideration both the case of a flat wall and of a cylindrical wall. These formulae are applied to the calculation of the wall effect in the ionization chamber connected to the Schmidt apparatus; the known formulae by Duane (empirical) and by Deij (approximated) are in fact not applicable in this case, since the dimensions of the chamber are small compared to the α-particle range. The results obtained by the application of the three formulae are compared. Mention is made of the extension of the method for establishing an analytical relation which allows the wall effect to be deduced when the dimensions of the chamber are known. A.

537.542

1405. IONIZATION CHAMBER FOR SHORT HALF-LIFE α EMITTERS. J.Olkowsky, G.Valladas and L.Cohen.
J. Phys. Radium, Vol. 17, No. 7, 587 (July, 1956). In French.

A very simple pulse ionization chamber is built for studying short half-life alpha emitters (≥ some minutes). The resolution is good and the background very low. A.

537.542

1406. RECENT PROGRESS IN THE FIELD OF SCINTILLATION COUNTERS. J.Labeyrie.
J. Phys. Radium, Vol. 17, No. 7, 576-80 (July, 1956). In French.

The present state of knowledge on photomultipliers, and on solid, liquid or gaseous phosphors for detecting nuclear particles is described. A.

537.542 : 621.318.2

1407. THE APPLICATION OF SQUARE-LOOP FERRITE MATERIAL IN DATA-PROCESSING SYSTEMS. E.P.G.Wright.
Proc. Instn Elect. Engrs, Paper 2234 R, publ. Oct., 1956, 10 pp. To be republished in Vol. 104 B (1957).

One application takes the form of buffers for modifying the speed or mode of presentation of data; a second concerns counters, distributors and scalers. It is shown that magnetic material can be used to replace electromagnetic switches, meters and relays and electronic triggers, counters and gates. A.

537.542 : 621.375.2

1408. 2 Mc/s BANDWIDTH AMPLIFIER TYPE A.P.T.1. H.Guillon.
J. Phys. Radium, Vol. 17, No. 7, 588-9 (July, 1956). In French.

A 2 Mc/s bandwidth pulse amplifier consisting of four separate units is described. The circuits were designed for correct transient response and minimum effect from overloads. Each amplifying unit can be used separately for pulse measurements in nuclear physics. A.

537.542

1409. OBSERVATIONS ON THE OPERATION OF A DIFFUSION CHAMBER. P.E.Argan, N.D'Angelo and A.Gigli.
R.C. Ist. Super. Sanità, Vol. 19, Pt 2-3, 117-50 (1956). In Italian.

A theoretical study was made of the characteristics of a permanently sensitive cloud chamber working by diffusion of methyl alcohol vapour in air at normal pressure and with a strong temperature gradient. The temperature, vapour pressure, and supersaturation distributions were calculated as functions of the number of ions formed per cm^3 per sec. The calculated height of the sensitive layer agrees well with experimental observations. The case was also studied in which the quantities involved are considered as functions of a horizontal coordinate as well as of height from the floor of the chamber. Information was obtained in this way about the deformation of the sensitive layer caused by plates of different materials and with given temperature distributions placed in the chamber, and in particular the order of magnitude was deduced of the minimum distance from the plates (or from the side walls) at which the tracks of ionizing particles could still be observed. A.

IONIZATION. THERMIONICS 537.56/.58

537.56

1410. TIME STUDIES OF IONIZATION PROCESSES. C.G.Morgan.
Appl. sci. Res. B, Vol. 5, No. 1-4, 18-22 (1955).

Measurements of the temporal growth of ionization between parallel plane electrodes in hydrogen have been made. The results show that for low values (~ 40 V/cm.mm Hg) of the ratio of electric field E to gas pressure p the growth times can be short (≤ 1 μsec for over-voltages $\Delta V \sim 1\%$) while at values of $E/p \sim 300$ V/cm.mm Hg the times are of the order of milliseconds with $\Delta V \sim 5\%$. Comparison of the experimental data with Davidson's mathematical analysis of current growth based upon the action of primary and secondary ionization processes shows that the relative significance of the possible secondary processes changes as E/p is altered. For the low values of E/p, the predominant secondary process contributing to the growth was found to be photoelectric emission from the cathode, but with increasing values of E/p the role of positive ion interaction with the cathode becomes increasingly important. No single secondary process was exclusively operating in any of the conditions examined. A.

537.56

1411. TOWNSEND IONIZATION COEFFICIENT FOR HYDROGEN AND DEUTERIUM. D.J.Rose.
Phys. Rev., Vol. 104, No. 2, 273-7 (Oct. 15, 1956).

The Townsend ionization coefficient α/p_0 (cm x mm Hg at 0^0 C)$^{-1}$ for hydrogen and deuterium has been measured as a function of E/p_0 (V cm^{-1} x mm Hg at 0^0 C) over an extended range. The results for H_2 have been compared critically with those of previous workers. They

agree well with several recent redeterminations over limited ranges of E/p_0, but not with several earlier extensive investigations. The composite results for H_2 ($15 < E/p_0 < 1000$), and present data for D_2 ($18 < E/p_0 < 600$), are presented in graphical and tabular form. The difference between the two coefficients is discussed in terms of the molecular properties of the two gases. It appears that the difference in energy loss by recoil on electron impact is insufficient to explain the observed effect. A.

537.56

1412. FORMATION OF NEGATIVE H IONS DURING THE PASSAGE OF POSITIVE H IONS ACROSS A SUPERSONIC JET OF MERCURY VAPOUR. Ya.M.Fogel', L.I.Krupnik and V.A.Ankudinov.
Zh. tekh. Fiz., Vol. 26, No. 6, 1208-21 (1956). In Russian.

A full description of the apparatus is given. Curves show how temperature and input power affect the ratio of I^-/I^+. Temperatures ranged up to 200°C and powers up to 30 kW. A maximum I^-/I^+ ratio of some 35% was obtained. Further experiments were carried out with oxygen. The equipment described gives negative ion beams of one order greater intensity than those obtained with Fite (Abstr. 2509/1953) gas discharge sources. C.R.S.Manders

537.56 : 539.132

CHARGE-EXCHANGE BETWEEN HELIUM ATOMS AND IONS. See Abstr. 1486

537.562

1413. DETERMINATION OF EFFECTIVE CROSS-SECTION FOR ELECTRON LOSS OF IONS OF ATOMIC NITROGEN IN THE RANGE OF ENERGY 485-1180 keV. M.I.Korsunskiĭ, L.I.Pivovar, A.M.Markus and Kh.L.Leviant.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 3, 399-402 (1955). In Russian.

An experimental method using magnetic analysis of differently charged nitrogen ions resulting from collisions of originally singly charged ions with nitrogen gas is described. Cross-sections for loss of varying number of electrons in this range of energy are given. G.Martelli

537.562

1414. ON THE APPLICABILITY OF THE RELATIONSHIP $(\sigma_{12}\,\sigma_{31}\,.\,\sigma_{23})/(\sigma_{21}\,\sigma_{13}\,.\,\sigma_{32}) = 1$, WHICH IS VALID IN THE CASE OF DETAILED EQUILIBRIUM, TO A GROUP OF IONS WITH STEADY-STATE COMPOSITION. M.I.Korsunskiĭ, Kh.L.Leviant and L.I.Pivovar.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 664-7 (1956). In Russian.

In the first part of this paper the assumptions under which this relation is valid are investigated, and a method for the analysis of the rather poor experimental material available at present is discussed. Then, with the help of an indirect procedure, the results of this investigation are compared with some experimental data deduced from a previous work (see preceding abstract): the good agreement which is found seems to prove the validity of the above mentions relation (in these measurements the exchange of charge between fast ions (nitrogen) and matter (air) occurred at the room temperature). G.Martelli

537.562

1415. AVERAGE IONIZATION ENERGY IN GASES. IONIZATION DEFECT. R.Genin.
J. Phys. Radium, Vol. 17, No. 7, 571-2 (July, 1956). In French.

The average energy required to produce an ion pair is determined, for Pu α-particles, in air, N_2, A and Ne. The ionization defect, analogous to the quantity defined by Knipp and Ling in their calculation on the ionization produced by heavy charged particles, is given for α-particles in air. A.

537.562

1416. METASTABLE IONS OF THE NOBLE GASES. H.D.Hagstrum.
Phys. Rev., Vol. 104, No. 2, 309-16 (Oct. 15, 1956).

It is shown that ions of the noble gases in metastable excited states may be detected by their greater ability, with respect to the normal ion, to eject electrons from an atomically clean metal surface. The metastable ions are produced by a single electron impact with the parent normal atom. The ratio of cross-sections for formation of the metastable and normal ions for argon, krypton, and xenon has been determined as a function of bombarding electron energy. At its maximum this ratio is about 0.02. The metastable ion must be observed over the "background" of normal ions in this method of detection, which is its inherent limitation. The relative number of helium ions formed in the $2\,^2S_{1/2}$ metastable state is below the detection sensitivity. It has been necessary to consider the nature of the interaction of a metastable ion with a metal surface, and an argument is given which indicates that the electron yield for the metastable singly-charged ion should be approximately equal to that measured for the doubly-charged ion. A.

537.562 : 539.153

1417. CONTINUOUS ABSORPTION COEFFICIENT OF THE HYDROGEN AND LITHIUM NEGATIVE IONS. S.Geltman.
Phys. Rev., Vol. 104, No. 2, 346-50 (Oct. 15, 1956).

Previous calculations of the continuous absorption coefficient of H^- were based on the use of ground state wave-functions obtained through the Ritz variational method. Such functions, although giving good values for the energy, are not in general adequate for the determination of the dipole matrix element needed for the absorption coefficient. Initial and final state functions are constructed for which the following necessary conditions on the true wave-functions are satisfied: (1) equality of dipole length, velocity, and acceleration matrix elements and (2) the $\langle r^2\rangle_{Av}$ and f sum rules. The constructed ground-state function is also shown to be reasonable on the basis of energy minimization. The resulting absorption coefficient for H^- is in substantial agreement with the best previously calculated curves and with experiment. The curve for Li^- is also obtained. A.

537.563

1418. CONCERNING THE CROSS-SECTION OF OVERCHARGING [CHARGE EXCHANGE] OF SLOW IONS IN THEIR OWN GAS. Yu.M.Kagan and V.I.Perel'.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 884-6 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 761-2 (July, 1956).

Cross-sections deduced in various ways from indirect measurements are compared with the direct observations of Ziegler (Abstr. 3613/1954) for the inert gases. The cross-section is concluded to be substantially independent of velocity from thermal energies up to 1-2 eV. R.S.Pease

537.564

1419. TEMPORAL GROWTH OF CURRENT BETWEEN PARALLEL PLATES. P.M.Davidson.
Phys. Rev., Vol. 103, No. 6, 1897 (Sept. 15, 1956).

It is pointed out that a mathematical solution of this problem given by Auer (Abstr. 2210/1956) is derived by an interesting method, but employs an erroneous argument and would need considerable alteration to make it satisfactory. P.M.Davidson

537.565

1420. TEMPERATURE DEPENDENCE OF THE MOBILITY OF POSITIVE IONS IN ARGON AND KRYPTON. E.C.Beaty.
Phys. Rev., Vol. 104, No. 1, 17-20 (Oct. 1, 1956).

The mobilities of positive ions of argon and krypton in the parent gases have been measured at room temperature and at one lower temperature, 77.4°K in argon and 90°K in krypton. In each case the atomic ions were found to have a higher mobility at the lower temperature. For A^+ in A, the mobility, extrapolated to zero field, at 77.4°K was 1.36 times the value at 300°K. Extrapolation could not be carried out accurately in krypton, but evidence is found that the ratio of the mobility at 90°K to the value at 300°K is somewhat larger than 1.2. The change in temperature was found to have no effect on the mobilities of the molecular ions. Agreement of the room temperature results with those of other investigators is good except for a large disagreement with Biondi and Chanin on the molecular ions. The disagreement is particularly large for A_2^+ at low E/p_0 and suggests a difference in the ions measured in the two experiments. A.

537.572

1421. AUGER EJECTION OF ELECTRONS FROM TUNGSTEN BY NOBLE GAS IONS. H.D.Hagstrum.
Phys. Rev., Vol. 104, No. 2, 317-18 (Oct. 15, 1956).

Previously published data on Auger ejection from tungsten include the effect of a 2% admixture of metastable ions in the ion beam for A, Kr, and Xe. Data on yield and kinetic energy distribution of electrons ejected by the normal singly-charged ion only are presented in this paper. A.

537.572

1422. GENERATION OF TANTALUM AND NICKEL IONS WHEN THE RESPECTIVE METALS ARE BOMBARDED BY POSITIVE CAESIUM IONS. V.I.Veksler and M.B.Ben'yaminovich.
Zh. tekh. Fiz., Vol. 26, No. 8, 1671-80 (1956). In Russian.

When investigating in a mass spectrometer the products of

the secondary emission of Ta and Ni targets bombarded by positive Cs ions, the Ta^+ and Ni^+ ions have been detected in quantities exceeding many times ($10^7 - 10^8$) those calculated from the Saha–Langmuir formula

$$\alpha_0 = n_i/n_a = A_0 \exp[(e/kT)(\varphi - v_i)],$$

where n_i and n_a are the numbers of ions and atoms which leave the surface during thermal evaporation with a work function of $e\varphi$; v_i is their potential of ionization, and $A_0 = g_i/g_n$ is the ratio of statistical weights of the ionic and atomic state. Similar discrepancy is obtained when one uses Dobretsov's formula (Trudy F.T.I. Akademii Nauk Uzbekskoĭ SSR, Vol. 3, 39, 1950), which differs from the preceding formula by v'_i (potential of ionization at the "mean critical recharging distance", x_{cr}) being substituted for v_i. The Cs^+ source used was a simplified modification of the source described in Bredov's paper (Abstract 1897/1951), and a magnetic mass spectrometer described in Veksler and Shuppe's paper (Zh. tekh. Fiz., Vol. 23, 1573, 1953) was used. The surface condition of the metals was checked by determining their work function using Richardson's method and the method of surface ionization. F.Lachman

537.581

1423. STUDY OF THE THERMIONIC EMISSION IN TRANSITION FROM A SOLID TO A LIQUID STATE. V.G.Bol'shov. Zh. tekh. Fiz., Vol. 26, No. 6, 1150-62 (1956). In Russian.

Measurements of thermal emission currents of Cu, Ag and Ge in solid and liquid states were made. The results show that, at the melting point, the emission current shows no sudden jump but the graph of temperature v. thermal emission changes its slope. This confirms that the intrinsic work function during transition from one aggregate state into the other does not change when the temperature coefficient of the work function experiences a jump. The jump in the thermal current at the melting point can be due to the gradual reorganization of atoms on the surface of the emitter when the temperature is increased, as well as due to the "crisis" in the surface structure at the melting point. The results of the measurements of work functions of Cu and Ag for full currents show satisfactory agreement with those already existing. The work function for Ge differs from that obtained by others and it appears to depend strongly on T in the region of natural conductivity. Z.F.Wojnar

537.583

1424. EMISSION OF OXIDE CATHODES SUPPORTED ON A CERAMIC. G.E.Moore and H.W.Allison.
J. appl. Phys., Vol. 27, No. 11, 1316-21 (Nov., 1956).

To reduce the physical and chemical complexity of the oxide coated cathode, the support metal and interface were eliminated by applying the (BaSr)O layer to a MgO ceramic which is electrically and chemically inert to (BaSr)O. The three interacting chemical phases of the usual oxide coated cathode are thereby reduced to a single phase — the oxide coat alone. At 1000°K, thermionic emission, measured by a pulse technique, is about 1 order of magnitude less than from modern commercial cathodes but considerably greater than from any other cathode system. The emission capability is unaffected by treatment in either atomic hydrogen or methane, which reduce BaO to Ba metal and thereby increase the Ba content of the oxide. The experiments were an attempt to test the usual assumption that emission in conventional oxide coated cathodes is determined by the composition of the (BaSr)O phase. The results suggest strongly that much of the complexity of practical cathodes is in the oxide layer itself and that factors other than the content of excess Ba are decisive for thermionic emission. A.

537.583 : 621.385.032

1425. ELECTRON TEMPERATURE IN OXIDE [COATED] CATHODES. D.G.Bulyginskiĭ and D.N.Dobretsov.
Zh. tekh. Fiz., Vol. 26, No. 5, 977-84 (1956). In Russian.

The electron temperature derived from the Richardson–Dushman formula is equal to the temperature of the cathode measured by a thermocouple for metallic cathodes but differs for oxide-coated cathodes. Causes of systematic error are discussed. The experiment is set up to exclude these errors. The results showed that electron temperatures were higher than the temperatures of the crystal lattice of the oxide-coated cathode when the latter varied from 500 to 1000°K the difference being higher for higher temperatures and equal to about 25 to 230 deg for the two limits, respectively. The explanations of this phenomenon suggested by some authors are enumerated. M.W.Makowski

COSMIC RAYS 537.591

537.591

1426. ANNOTATED BIBLIOGRAPHY ON COSMIC RAYS IN THE ATMOSPHERE (- 1952). M.L.Rice and G.Thuronyi. Meteorol. Abstr., Vol. 7, No. 3, 361-93 (March, 1956).

537.591

1427. ANNOTATED BIBLIOGRAPHY ON COSMIC RAYS IN THE ATMOSPHERE (1953-1956). M.L.Rice and G.Thuronyi. Meteorol. Abstr., Vol. 7, No. 4, 488-531 (April, 1956).

537.591.1 : 539.18

1428. THE MOMENTUM SPECTRUM OF μ-MESONS AT A DEPTH OF 40 METRES WATER EQUIVALENT. W.F.Nash and A.J.Pointon. Proc. Phys. Soc. A, Vol. 69, Pt 10, 725-33 (Oct., 1956).

Scattering distributions, obtained in two lead plates, each 2 cm thick, placed in a cloud chamber situated at a depth of 40 m water-equivalent, have been used to determine the momentum spectrum of μ-mesons in the range 0.22-1.0 GeV/c. The spectrum is in good agreement with the spectrum derived from the sea-level data of Holmes and co-workers. A.

537.591.15

1429. THE ENERGY SPECTRUM OF EXTENSIVE AIR SHOWERS. R.J.Norman.
Proc. Phys. Soc. A, Vol. 69, Pt 11, 804-20 (Nov., 1956).

The integral shower density spectrum from 20-1000 particles per square metre is measured with three-fold proportional counters 60 m above sea-level, and follows a law

$$\nu(\rho) = 540\,\rho^{-1.39 \pm 0.04}\ h^{-1}, \text{ for } \rho < 500 \text{ particles m}^{-2},$$

in agreement with previous Geiger-counter results; an agreement which confirms energy loss measurements as a means of particle density determination. For $\rho > 500$ the exponent increases quickly, reaching 2.2 at $\rho = 1000$, which is typical of the value observed with ionization chambers. The density spectrum is analysed, allowing for effects of shower age on structure to obtain the distribution in number

$$S(N) = 2.3 \times 10^{-4}(N \times 10^{-6})^{-1.47 \pm 0.1}\ m^{-2}h^{-1},$$

with evidence for a rapid increase in exponent above $N = 10^6$ particles. Using cascade theory the latter is shown to be produced by a primary energy spectrum

$$V(E) = 0.32\,(E \times 10^{-14})^{-1.8}\ m^{-2}h^{-1}\ \text{sterad}^{-1},$$

for $10^{13} < E < 10^{15}$, above which the exponent increases rapidly, reaching about −3 at $E = 10^{17}$ eV. Since shower primaries of these energies should be little affected by solar or terrestrial magnetic fields, this will be the form of the primary spectrum. A.

537.591.15

1430. EMISSION OF COSMIC RAY SHOWERS IN LEAD. H.Faissner, K.H.Lauterjung and B.Schimmer.
Z. Naturforsch., Vol. 11a, No. 7, 549-55 (July, 1956). In German.

Measurements are described of the emission of showers in Pb up to 36 cm thick. The Rossi curves obtained by using different arrangements of crossed counters with an anticoincidence screen are reproduced. The apparent absorption length in Pb exceeding 10 cm in thickness is given as (210 ± 30) cm of Pb. The results are compatible with the assumption that the charged particles released are μ-mesons with accompanying electrons. H.J.H.Starks

537.591.2

1431. ENERGY SPECTRUM OF π-MESONS PRODUCED BY COSMIC RAYS IN PHOTOGRAPHIC EMULSIONS. A.A.Varfolomeev, R.I.Gerasimova, E.A.Zamchalova, M.I.Podgoretskiĭ and M.N.Shcherbakova.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1164-6 (1956). In Russian.

A study is carried out of the energy spectrum of π-mesons of energy below 70 MeV produced by cosmic rays in emulsions exposed in the stratosphere. Complete tracks of 195 π^+- and 328 π^--mesons were found. There seems to be a difference between the π^+- and π^--spectra, which might be explained by Λ^0 production and decay in the same nucleus. G.E.Brown

537.591.5

1432. COSMIC-RAY INCREASE AT HIGH ALTITUDE ON FEBRUARY 23, 1956. J.R.Winckler.
Phys. Rev., Vol. 104, No. 1, 220 (Oct. 1, 1956).

A vertical telescope with a stopping power of 22 g/cm^2 was flown to an atmospheric depth of 10 g/cm^2 at Minneapolis seventeen

hours after the beginning of the giant solar flare and cosmic-ray increase of February 23, 1956. The cosmic-ray intensity was normal below 300 g/cm^2, but at 10 g/cm^2 was five times the normal intensity at Minneapolis. The particles apparently have energies less than one BeV, presumably originated near the sun and reached the earth by scattering from magnetic fields near the solar system. A.

537.591.5 : 550.371 : 550.38 : 523.75

COSMIC RADIATION AND SOLAR–TERRESTRIAL RELATIONSHIPS. See Abstr. 1025

MAGNETISM 538

538.082

1433. THE MEASUREMENT OF SMALL FORCES BY MEANS OF A MOVING COIL METER WITH AN APPLICATION TO MAGNETIC SUSCEPTIBILITY MEASUREMENTS.
J.A.Poulis, L.J.Poldervaart and P.Teunissen.
Appl. sci. Res. B, Vol. 6, No. 1-2, 124-8 (1956).

A method is described for the measurements of small forces (10^{-5}-10^{-3} newton) on a sample weighing a few grams. This sample is placed on a bar which is fixed on the turning coil of an ordinary switchboard current meter. The force on the sample can be compensated by the Lorentz force on the current through the coil. This method avoids a great many of the usual constructional difficulties of such apparatus and leads to a robust instrument which is easy to handle and to automatize, thus being of interest for use outside the laboratory. This possibility in particular led to the choice of a magnetic susceptibility balance as an example. For magnets of field strength up to 20 000 Oe the precision obtained for the measured susceptibility amounts to one tenth of a per cent. A.

538.082.74

1434. VIBRATING SAMPLE MAGNETOMETER. S.Foner.
Rev. sci. Instrum., Vol. 27, No. 7, 548 (July, 1956).

Describes a magnetometer based on the detection of the dipole field from an oscillating magnetic sample placed in a uniform magnetic field. Positioning of the detection coils is discussed and a null detector described. Measurements of the magnetic moment of a 1.2 mm diameter nickel sphere have been made to 0.5%. A.E.De Barr

538.1 : 523.877

ON FORCE-FREE MAGNETIC FIELDS. See Abstr. 1034

538.11

1435. THE THEORY OF ATOMIC MAGNETIC MOMENTS IN FERROMAGNETICS. N.S.Akulov.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 935-8 (1955). In Russian.

Developments in the zone theory of ferromagnetism together with more recent work on the elucidation of the peculiarities in the filling of 3d- and 4s-shells of atoms have enabled the author to give a purely theoretical calculation for the atomic magnetic moments of Fe and Co at high temperatures. For this the s–d electron distribution is assumed to be that given by the probability of transition of electrons from s- to d-shells and vice versa. Hund's rule is also applied. Calculated values for the number of unpaired 3d-electrons obtained by this theory of $T > \theta_{Curie}$ are in excellent agreement with those obtained in magnetic and neutron diffraction studies for $T < \theta_{Curie}$. When attempting to develop the notions into a general theory it is found that at low temperatures the effect of exchange interactions upsets the electron distribution considered above. Further discussion of s–d interaction leads to the calculation of atomic magnetic moments in alloys. This is applied with special relevance to Fe–Co, Fe–Cr, Co–Ni, Ni–Cu alloys. C.R.S.Manders

538.11

1436. THEORY OF FERRO-, PARA-, AND FERRIMAGNETISM. N.S.Akulov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 603-6 (1956). In Russian.

Theoretical paper. The author developes ideas of an earlier communication (see preceding abstract) in which magnetic properties are related to the total numbers of electrons in the s and d bands, and discusses Co–Ni, Ni–Cu, Fe–Ce alloys by way of illustration. C.R.S.Manders

538.114

1437. A NOTE ON THE GROUND STATE OF ANTIFERROMAGNETISM. H.Taketa and T.Nakamura.
J. Phys. Soc. Japan, Vol. 11, No. 9, 919-23 (Sept., 1956).

Kasteleijn's method of obtaining the ground state of antiferromagnetism is generalized to the cases of two- and three-dimensional lattices. According to the generalization, the ground state of the three-dimensional antiferromagnetic Heisenberg model with the spin quantum number equal to one half is paramagnetic in the absence of anisotropy energy. The magnetization of sublattices is calculated as a function of the degree of anisotropy. With increasing coordination numbers the anisotropy energy necessary for establishing the antiferromagnetic state decreases rapidly. A.

538.114

1438. THE ANISOTROPY CORRECTION IN FERROMAGNETIC RESONANCE. K.J.Standley and K.W.H.Stevens.
Proc. Phys. Soc. B, Vol. 69, Pt 10, 993-6 (Oct., 1956).

A method is described for finding the net absorption, at a given magnetic field, resulting from the superposition of absorption lines from the randomly distributed crystallites of a polycrystalline material. It is then shown that, due to magnetocrystalline anisotropy, the maximum in a ferromagnetic resonance curve does not coincide with the centre of gravity of the absorption line. This is important because the usual resonance equation $h\nu = g\beta H$ implies the use of the centre of gravity field, so that to obtain the true g a correction must be made to the field for maximum absorption. The magnitude of the correction depends on K_1/M and is estimated numerically. A.

538.114 : 538.562

1439. THE QUANTUM THEORY OF THE MAGNETOSTRICTION OF CUBIC MONOCRYSTALS OF FERROMAGNETICS AT LOW TEMPERATURES. A.A.Gusev.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 895-7 (1955). In Russian.
English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 764-6 (July, 1956).

Earlier results on crystals of hexagonal symmetry are here extended to cubic crystals. Special difficulties connected with this are discussed and finally expressions for the magnetostriction constants are obtained which show their temperature dependence. F.E.Hoare

538.12 : 621.3.013.2

1440. STUDY OF THE TOPOGRAPHY OF THE NON-UNIFORM PLANE MAGNETIC FIELD OF A SIX-POLE ELECTROMAGNET. M.I.Korsunskiĭ, Ya.M.Fogel', G.A.Bykova, L.I.Livshits, N.S.Lozovskiĭ and A.A.Chovnik.
Zh. tekh. Fiz., Vol. 26, No. 6, 1222-32 (1956). In Russian.

Describes the construction of a six-pole electromagnet for focusing of beams of particles which possess magnetic moment. The form of the field is discussed theoretically and a search coil arrangement for verifying the field lay-out is described. Measurements show that a field can be set up with not more than 0.1% distortion over a circle of 10 cm radius. C.R.S.Manders

538.22

1441. ON THE FERRIMAGNETISM OF SOME SULPHIDES AND OXIDES. F.K.Lotgering.
Philips Res. Rep., Vol. 11, No. 3, 190-249 (June, 1956).

Reports results of crystallographic and magnetic investigations on the compounds Fe_xS ($0.853 < x < 1$). Below about 330° C ferrimagnetic behaviour arises as a result of ordering of spins as well as of Fe vacancies. Above this temperature Curie–Weiss paramagnetism was observed. For $Fe_{0.9}S$ a further order–disorder transition was observed at 210° C, but this could be inhibited by quenching. Measurements below and above the Curie points are also reported for the compounds MCr_2O_4(M = Fe, Ni) and MCr_2S_4(M = Mn, Fe, Co, Zn), and the results are interpreted on the basis of Yafet and Kittel's theory, modified to take account of the presence of two types of magnetic ion. E.P.Wohlfarth

538.22

1442. ON THE FERRIMAGNETISM OF SOME SULPHIDES AND OXIDES. F.K.Lotgering.
Philips Res. Rep., Vol. 11, No. 4, 337-50 (Aug., 1956).

A continuation of the preceding abstract. Magnetic measurements are reported on MCo_2O_4(M = Mn, Fe, Ni, Co, Zn), Co_3S_4, $NiCo_2S_4$ and Co_9S_8. Only MCo_2O_4 (M = Mn, Fe, Ni) exhibit spontaneous magnetization. The Fe compound exhibits high coercive force, 1.3 x 10^4 oersted at 77° K, which decreases rapidly with rising temperature. For the Ni compound the magnetization temperature curve

has an anomalous shape. Paramagnetic measurements are reported for all the compounds. The results are discussed in connection with the lattice structure. E.P.Wohlfarth

538.22

1443. MAGNETIC SUSCEPTIBILITY OF αMnS. J.J.Banewicz and R.Lindsay.
Phys. Rev., Vol. 104, No. 2, 318-20 (Oct. 15, 1956).

The magnetic susceptibility of a powder sample of αMnS was measured from 90°K to 800°K by an absolute Gouy method. The Néel temperature was found to be 154°K. There was no evidence of thermal hysteresis and the susceptibility was independent of field strength over a range of fields between 2000 and 3000 oersteds. Two sets of Weiss–Curie constants fitted the data above the Néel temperature. Between the Néel temperature and 300°K, values of $\theta = 490°K$ and $C_M = 4.40$ were calculated. Above 400°K, the respective values were 380°K and 3.90. It is suggested that the persistence of short-range ordering effects to temperatures well above the Néel temperature affects the value of these constants and that the values above 400°K are probably more representative. A.

538.22

1444. THE MAGNETIC SUSCEPTIBILITIES OF TWO POLYMORPHIC FORMS OF MANGANESE SULPHIDE. W.S.Carter and K.W.H.Stevens.
Proc. Phys. Soc. B, Vol. 69, Pt 10, 1006-12 (Oct., 1956).

The magnetic susceptibilities of two polymorphic forms of MnS, one of zinc blende type and the other of wurtzite type have been measured. Antiferromagnetism occurs in the former at 100°K, with θ/T_C equal to 9.4 . The results are discussed in the light of current views on antiferromagnetism and it is concluded that in the wurtzite type it may not be possible to form magnetic super-lattices. Some ordering will however occur, but it is not clear whether this can be detected magnetically. The considerations are extended and applied to the rare earth metals. A.

538.221 : 621.318.12

1445. THE PHYSICAL AND CHEMICAL PROPERTIES OF SOME NICKEL–ZINC FERRITE COMPOUNDS. N.C.Tombs and J.Watkins.
Proc. Instn Elect. Engrs, Paper 2235 R, publ. Oct., 1956, 9 pp. To be republished in Vol. 104 B (1957).

The work reported forms part of a general investigation aimed at elucidating the mechanisms giving rise to magnetic and dielectric losses in ferrites. For this purpose the nickel–zinc ferrite system was chosen as a simple system containing materials whose properties fall within a convenient range for measurement. In particular, the paper describes the preparation and some properties of a series of nickel–zinc ferrites in which the iron content has been made less than the stoichiometric value. The primary aim in preparing these materials was to find to what extent the resistivity at microwave frequencies could be increased in such iron-deficient preparations. Although an increase of the resistivity at 9.6 Gc/s from about 50 ohm-cm to 500 ohm-cm is obtained, this alone would not be adequate for practical materials. Other properties of the materials have been measured and their variation with iron content explained. A.

538.221 : 621.395.625.3

1446. NOISE IN MAGNETIC RECORDING TAPES. D.H.Howling.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 977-87 (Sept., 1956).

A theoretical and experimental investigation is made into the mechanism of noise in magnetic media as used in magnetic recording. It is shown that the basic noise in a wow and flutter free system arises from the fact that the domain size in metals or the particle size of oxides is finite, and improvement in the lower limit of noise can only be made by the reduction of particle or domain size. The effect of impressed a.c. and d.c. magnetization on the noise level is also examined. A theoretical value for the tape noise arising from the particle nature of an oxide medium has been derived by taking into account the modern theories of magnetism of the iron oxides and evaluating exactly the mathematical function f(x) which appears in the noise equation. Good agreement with the observed noise voltage is obtained. It is also shown that the basic wide-band unmagnetized tape noise level of 0.6 μV for the head employed is extremely low and that for the ideal system the theoretical signal/wide-band unmagnetized tape noise ratio is independent of tape velocity and varies as the square root of the track width. A.

538.221

1447. CONDITION FOR RESONANCE IN A NEARLY COMPENSATED FERRIMAGNETIC. K.F.Niessen.
Philips Res. Rep., Vol. 11, No. 1, 57-65 (Feb., 1956).

The resonance condition is derived for a ferrimagnetic with two sublattices with different total moments, different anisotropy constants and different gyromagnetic ratios. These three differences are supposed to be relatively small and their influence on the resonance frequency is to be found from the resonance equation. It may be used for an antiferromagnetic in whose sublattices a relatively small number of magnetic ions has been substituted by non-magnetic ones. A.

538.221

1448. MULTIPLE FERROMAGNETIC RESONANCE IN FERRITE SPHERES. R.L.White and I.H.Solt, Jr.
Phys. Rev., Vol. 104, No. 1, 56-62 (Oct. 1, 1956).

Ferromagnetic resonance experiments have been performed on single crystal spheres of manganese and manganese-zinc ferrites placed in field configurations having large gradients in the r.f. magnetic field at the sample site. Five major and several minor resonant absorptions are observed extending over a region of 700 oersted at room temperature. The line spacings are essentially independent of sphere size. The absorptions are shown to be attributable to modes of precession of the bulk magnetization of the sample which are more complicated than the spatially uniform precession contemplated by the usual ferromagnetic resonance theory. The lowest order modes are identified and their dynamical properties shown to be consistent with the prediction of an idealized magnetically-coupled-oscillator model. A.

538.221

1449. PHYSICAL CONDITIONS FOR FERROMAGNETIC RESONANCE. J.E.Mercereau and R.P.Feynman.
Phys. Rev., Vol. 104, No. 1, 63 (Oct. 1, 1956).

All but one of the multiple ferromagnetic resonances observed by White and Solt (preceding abstract) in a sphere are shown to correspond to modes in which the oscillating part of the magnetization is independent of r (the only case ordinarily considered) or varies linearly with r in the sample. A.

538.222 : 532.7

1450. EFFECT OF ANISOTROPIC HYPERFINE INTERACTIONS ON PARAMAGNETIC RELAXATION IN LIQUIDS. H.M.McConnell.
J. chem. Phys., Vol. 25, No. 4, 709-11 (Oct., 1956).

A simple "microcrystalline model" is developed to discuss the effect of molecular motion in the liquid state on the paramagnetic relaxation of ions or molecules with spin $S = \frac{1}{2}$. This theory relates the paramagnetic relaxation times T_1 and T_2' to the anisotropy in g, $\Delta g = g_{\parallel} - g_{\perp}$, to the anisotropy in the nuclear hyperfine interaction, A–B, and to the correlation time τ_C which describes the Brownian tumbling motion of the microcrystal in the liquid state. The contribution of the anisotropic hyperfine interaction to the paramagnetic relaxation turns out to depend on the nuclear spin quantum number I_Z, so that different hyperfine multiplets in a paramagnetic resonance spectrum can show different line widths. A.

538.222

1451. PARAMAGNETISM AND ELECTRON DISTRIBUTION IN THE COMPOUNDS $CrAl_4$, Co_2Al_5 AND Co_4Al_{13}. G.Foex and J.Wucher.
J. Phys. Radium, Vol. 17, No. 5, 454-5 (May, 1956). In French.

Reports results of susceptibility measurements between room temperature and 1000°K. For all three compounds the susceptibility is almost temperature independent, and for the last two it is concluded that the Co ions have filled d shells. E.P.Wohlfarth

538.222

1452. RELAXATION IN THE SPIN SYSTEM OF PARAMAGNETIC SALTS. L.J.Smits, H.E.Derksen, J.C.Verstelle and C.J.Gorter.
Physica, Vol. 22, No. 9, 773-84 (Sept., 1956).

Paramagnetic absorption is studied in a number of salts at 20.4°K. This absorption is not due to interaction of the spin system with the lattice, which has been satisfactorily described by Casimir and Du Pré's formulae, but to relaxation within the spin system. Three different types of behaviour may be distinguished which differ from each other in the relative magnitude of magnetic and exchange broadening compared to the electrical splitting of the ground state. The

results are in striking disagreement with Broer's theory but seem to confirm an earlier treatment of Kronig and Bouwkamp. A.

538.222

1453. THE MAGNETIC SUSCEPTIBILITIES OF PALLADIUM–URANIUM ALLOYS. L.F.Bates and S.J.Leach.
Proc. Phys. Soc. B, Vol. 69, Pt 10, 997-1005 (Oct., 1956).

Measurements are made of the paramagnetic susceptibilities of palladium–uranium alloys covering the range of solid solution, of an intermetallic compound Pd_3U and of specimens of very pure palladium and uranium over the temperature range 77° to 293°K. Increasing amounts of uranium cause a rapid decrease of susceptibility up to a concentration of 9 atomic %. Further increase in the amount of uranium causes a rapid rise in susceptibility, alloys of concentrations greater than 12 atomic % obeying a Curie–Weiss law with an effective atomic moment of 3.14 Bohr magnetons. The results are discussed in relation to the properties of the palladium–silver system and close similarity is found for low concentrations assuming that uranium is six times more effective than silver. The temperature-dependent susceptibilities of the alloys of higher uranium content are explained by a change in the valency of uranium leaving two unpaired electrons localized on uranium atoms. An annealed alloy of concentration 17.6 atomic % uranium showed an unexplained time dependence of susceptibility. A.

538.222 : 538.224

1454. MAGNETIC PROPERTIES OF Mg_2Sn. L.L.Korenblit and A.P.Kolesnikov.
Zh. tekh. fiz., Vol. 26, No. 5, 941-4 (1956). In Russian.

Earlier work by Boltaks on pressed powders of Mg_2Sn stoichiometric composition showed diamagnetic susceptibility increasing with temperature. Further excess of one or other constituent with respect to stoichiometric composition gave a paramagnetic susceptibility decreasing with temperature. It was considered that the diamagnetism is characteristic of the Mg_2Sn crystal lattice and that the paramagnetism is due to the paramagnetism of impurity ions. The present authors have repeated the measurements over a temperature range of +20 to +210° C with alloys of very high purity (not more than 0.01% Pb or Sb) and have found substantially the same results as Boltaks. They also measured the electrical conductivity and thermoelectric e.m.f. The Hall effect for one "impure" specimen was measured at room temperature. It is concluded that the results indicate that the paramagnetism of "impure" specimens is associated with the paramagnetism of free electron gas in the Mg_2Sn crystal. C.R.S.Manders

538.224 : 538.114

1455. STATISTICAL CHARACTER OF THE REVERSAL OF MAGNETIZATION OF FERROMAGNETICS. F.V.Bunkin.
Zh. tekh. Fiz., Vol. 26, No. 8, 1782-9 (1956). In Russian.

An examination is made of the basic assumptions made concerning the behaviour of a ferromagnetic domain. The paper then goes on to derive a mathematical description, using Markov chains, of domain behaviour under cyclic reversal of magnetization. Also discussed are the dependence of the possibility of transition of a domain upon the macroscopic state, and the statistical scatter of transition moments. C.R.S.Manders

538.24

1456. ON THE MINIMUM OF MAGNETIZATION REVERSAL TIME. R.Kikuchi.
J. appl. Phys., Vol. 27, No. 11, 1352-7 (Nov., 1956).

A modified Landau–Lifshitz equation is solved for a single-domain sphere and an infinitely-wide thin single-domain sheet of ferromagnetic material neglecting anisotropy. The external magnetic field is switched from one direction to its opposite instantaneously at the initial time and the behaviour of the magnetization vector is investigated thereafter. It is shown that there is a critical value of the damping constant corresponding to the minimum value of the (repetitive) magnetization reversal time. If the damping constant is larger than the critical value, the magnetization vector moves slower; if it is smaller, the magnetization vector moves faster but oscillates so that it takes longer time until it comes to a rest at the final position. The critical values of the Landau–Lifshitz damping constant λ are γM for the sphere and $0.013\gamma M$ for the thin sheet, where γ and M are the gyromagnetic ratio and the magnetization, respectively. The computed minimum switching time for the thin sheet of 4-79 molybdenum Permalloy is of the order of 10^{-9} sec. A.

538.24

1457. THE MAGNETIZATION PROCESSES NECESSARY FOR THE TEMPERATURE MAGNETIC HYSTERESIS EFFECT IN FERROMAGNETICS. N.A.Baranova and Ya.S.Shur.
Dokl. Akad. Nauk SSSR, Vol. 94, No. 5, 825-7 (1954). In Russian.

538.245 : 548.

1458. "LOZENGE" AND "TADPOLE" DOMAIN STRUCTURES ON SILICON–IRON CRYSTALS. L.F.Bates and P.F.Davis.
Proc. Phys. Soc. B, Vol. 69, Pt 11, 1109-11 (Nov., 1956).

New photographs of "lozenge" patterns (Paxton and Nilan) and of "tadpole" patterns (Bates and Hart) on silicon–iron crystals are recorded, and models are given for their interpretation. A

ELECTROMAGNETISM. ELECTRODYNAMICS 538.3/.5

538.3

1459. ON THE VARIATIONAL PRINCIPLE OF DIELECTRICS. G.Marx.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 1, 29-35 (1956).

Discusses the application of the variational principle to the motion of (a) a neutral, and (b) a charged ideal fluid. Shows that by choosing for the Lagrangian the simplest possible invariants of the problem the variational principle leading to the correct equations of motion can be directly obtained. It is confirmed, in agreement with Novobátzky (Acta phys. Hungar., Vol. 1, No. 5, 1949), that the application of the variational principle makes it possible to solve the energy–momentum problem of the phenomenological electrodynamics in an unambiguous manner, free from arbitrary assumptions. J.W.Gardner

538.3

1460. THE EQUATION OF MOTION OF A MAGNETIC DIPOLE. K.Nagy.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 6, 341-5 (1956). In German.

The equation of motion is derived by using the linear field theory of Infeld (Abstr. 7678/1955). An equation is also derived giving the time dependence of the rest-mass. E.P.Wohlfarth

538.3 : 531.55 : 531.52

LEVITATION USING ELECTROMAGNETIC FORCES. See Abstr. 1090

538.3 : 532

1461. THE MAGNETIC FIELD IN A CONDUCTING TURBULENT LIQUID IN TWO-DIMENSIONAL MOTION. Ya.B.Zel'dovich.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 154-5 (1956). In Russian.

A rigorous treatment of the problem studied by Batchelor (Abstr. 4746/1950) is possible if motion is restricted to two dimensions. Unlike Batchelor, who found an exponential increase in the magnetic energy of the system, the author obtains an initial increase followed by an exponential decay. In the presence of external fields, the field in the moving liquid become proportional to the external fields. J.B.Arthur

ELECTROMAGNETIC WAVES AND OSCILLATORS 538.56

538.56 : 532.5

1462. THE STRUCTURE OF MAGNETOHYDRODYNAMIC SHOCKS. W.Marshall.
Atomic Energy Res. Establ. (Harwell) Rep. No. T/R 1718, 31 pp. (1955).

The structure of a plane shock in an ionized gas in the presence of a magnetic field which is perpendicular to the line of flow is examined theoretically. It is shown that the nature of the flow depends upon the magnitude of a parameter β which is determined by the electrical conductivity, i.e. by the temperature and number density of electrons, in the undisturbed gas. For small values of β, corresponding to high electrical

conductivity, the magnetic field is closely proportional to the density of the gas and the shock front has a width of several mean free paths. For large values of β, corresponding to low electrical conductivity, if the initial magnetic field is smaller than a certain critical value (which depends upon the strength of the shock) the shock front consists of a region of width equal to several mean free paths in which the velocity, temperature, pressure and density change rapidly but in which the field remains constant, preceded by a region of width $\cong \beta$ mean free paths (which is large) in which all the variables change slowly. If the magnetic field is larger than this critical value the narrower region does not occur and the shock front consists of a single region, of width $\cong \beta$ mean free paths, in which all the variables change slowly. An interesting effect which occurs for ordinary (H = 0) shocks taking place in an ionized gas but not for ordinary shocks in an unionized gas is discussed first. A.

538.56 : 532.5

1463. THE GROWTH IN TIME OF A HYDROMAGNETIC SHOCK. W.Marshall.
Atomic Energy Res. Establ. (Harwell) Mem. No. T/M 135, 5 pp. (1956).

In a previous report (see preceding abstract) the structure of steady hydromagnetic shocks was discussed theoretically and it was shown that the situation most likely to be met with experimentally was that in which an ordinary hydrodynamic shock was preceded by a region of width $\cong c^2/4\pi\sigma u_1$ cm, where σ = electrical conductivity and u_1 = velocity of the shock, in which the magnetic field changed slowly. In this report the time development of such a shock is considered and an estimate of the time required to set up the steady state is given. It is shown that the magnetic field increases rapidly in front of the shock until the steady state is set up; when this is done the shock has travelled about $16\ c^2/4\pi\sigma u_1$ cm. The time required to set up a steady state behind the shock is longer. The field is shown graphically as a function of the distance from the hydrodynamic shock for various times. A.

538.566

1464. REFLECTION AT ARBITRARY INCIDENCE FROM A PARALLEL WIRE GRID. J.R.Wait.
Appl. sci. Res. B, Vol. 4, No. 6, 393-400 (1955).

A solution is outlined for the problem of a plane wave, incident obliquely, with arbitrary polarization, on a planar grid. It is assumed that the wires composing the grid are of homogeneous material and that their diameter is small compared with the separation. The general result when specialized to parallel polarization agrees with published results. A.

538.566 : 621.371

1465. THE PROBLEM OF DIFFRACTION OF ELECTROMAGNETIC WAVES AT A CIRCULAR APERTURE IN A PLANE SCREEN. N.I.Akhiezer and A.N.Akhiezer.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 1, 53-6 (1956). In Russian.

Using the method described in a previous paper (Dokl. Akad. Nauk SSSR, Vol. 98, No. 3, 333-6, 1954) an integral equation is obtained and solved. S.C.Dunn

538.566

1466. DIFFRACTION OF FINITE ELECTROMAGNETIC WAVE PACKET BY CYLINDRICAL OBSTACLE. E.L.Burshtein and L.S.Solov'ev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 473-6 (1956). In Russian.

To obtain the diffraction pattern the paper treats an arbitrary finite wave packet as a superposition of appropriate plane waves, using results previously established for the latter. J.W.Gardner

538.566

1467. DIFFRACTION OF PLANE ELECTROMAGNETIC WAVES BY A CONDUCTING CYLINDER. A.S.Goryainov.
Dokl. Akad. Nauk SSSR, Vol. 109. No. 3, 477-80 (1956). In Russian.

The current density and electromagnetic field strengths in and around the cylinder are calculated. By using an asymptotic expansion the exact expressions for these quantities simplify considerably; the exact and asymptotic formulae are compared graphically and the latter are seen to be adequate for all practical purposes. J.W.Gardner

538.566 : 621.396.11

1468. THE DIFFRACTION OF AN ELECTROMAGNETIC WAVE BY A LARGE APERTURE. R.F.Millar.
Proc. Instn Elect. Engrs, Monogr. 213 R, publ. Dec., 1956, 11 pp. To be republished in Part C.

With the aid of methods previously developed (Abstr. 507/1956), an approximate expression is obtained for the difference from unity of the transmission coefficient for plane waves at normal incidence of a large aperture of rather general form in a plane perfectly-conducting screen. The coefficient is expressed in the form of one or more line integrals taken around all (or part) of the aperture rim. These may be evaluated analytically in certain cases, e.g. a circular or elliptical aperture. In the former case the result agrees with that derived elsewhere (Abstr.7556/1956); the ellipse is considered in some detail, and the transmission coefficient is evaluated for a range of eccentricities. The results appear to be in qualitative agreement with the limited experimental data available. A.

538.566 : 535.42

CROSS-SECTION THEOREM FOR ELECTROMAGNETIC WAVES. See Abstr. 1214

538.566 : 535.43 : 534.26

ON THE SCATTERING OF SPHERICAL WAVES BY A CYLINDRICAL OBJECT. See Abstr. 1146

538.566

1469. FERRITE POST IN A RECTANGULAR WAVE GUIDE. P.S.Epstein and A.D.Berk.
J. appl. Phys., Vol. 27, No. 11, 1328-35 (Nov., 1956).

A thin circular ferrite post magnetized lengthwise is placed in a rectangular waveguide with its axis normal to the direction of propagation of the incident waves. The polarization is such that the electric vector is parallel to the post. The reflected and transmitted waves are calculated both with respect to their intensities and phases. The results are also applied to find the influence of a thin ferrite post upon the resonant frequency of a rectangular cavity. A.

538.566.3 : 551.510.535 : 523.3

EFFECT OF IONOSPHERE ON RADIO ECHOES FROM THE MOON. See Abstr. 1017

538.566 : 538.61 : 621.318.12.029.6

1470. INTRODUCTION TO THE STUDY OF MAGNETO-OPTICAL PHENOMENA IN FERRITES IN THE HYPERFREQUENCY REGION. J.Benoit.
Onde élect., Vol. 36, 499-507 (June, 1956). In French.

An account of ferromagnetic resonance and of the Faraday effect and magnetic birefringence. The effects observed when a magnetic material is placed in a waveguide are considered, and some typical results are given. Some of the applications to waveguide transmission systems are discussed. A.E.De Barr

538.566 : 621.372.8 : 621.318.12

1471. RELATIONS BETWEEN THE STRUCTURE OF FERRITES AND THE CONDITIONS OF THEIR RESONANCE IN WAVEGUIDES. UNIDIRECTIONAL GUIDES. J.Suchet.
Onde élect., Vol. 36, 508-19 (June, 1956). In French.

An account of the atomic and molecular structure of ferrites with particular relation to the factors determining the conditions for magnetic resonance. The effects of shape and of density are considered. The application of these data to the construction of a unidirectional waveguide are considered also and details of the performance of such a waveguide are given. A.E.De Barr

MOLECULAR AND ATOMIC STRUCTURE

539.1

THEORY OF SOLID STATE 539.11

539.11 : 548.7

1472. THE BINDING OF METALLIC SILVER. G.Gáspár and B.Molnár.
Acta phys. Hungar., Vol. 6, No. 1, 119-23 (1956). In German.

Results of the calculation of the lattice energy and lattice constant of Ag on the basis of the model of Gombas (Abstr.

8969/1952) are given. The effect of the overlapping of the closed shells of the ions on the lattice energy has been investigated and the energy contribution due to it found to be about double that in the case of Cu. M.R.Hopkins

539.11 : 548.7

1473. SOME CALCULATIONS OF THE SURFACE ENERGY OF MAGNESIUM OXIDE. G.C.Benson and R.McIntosh.
Canad. J. Chem., Vol. 33, No. 11, 1677-81 (Nov., 1956).

Calculations of the surface energy of an undistorted {100} face of crystalline magnesium oxide have been made. An exponential form of the repulsive energy term was used, and the van der Waals attractive energy between dipoles was included, as in the Born–Mayer treatment of cohesive energy. Comparison with earlier work is made, and it is shown that results are markedly dependent upon the form of the repulsive potential term, the inclusion of the van der Waals terms, and, indeed, the choice of coefficients of the van der Waals term. This is not the case so far as the calculated cohesive energies are concerned. The results indicate that a Born–Mayer model may be inadequate in the case of magnesium oxide, and that caution must be exercised before accepting surface energies arrived at by such calculations. A.

539.11

1474. ENERGY LEVELS OF A DISORDERED ALLOY. R.H.Parmenter.
Phys. Rev., Vol. 104, No. 1, 22-32 (Oct. 1, 1956).

A study is made of the one-electron energy levels of a disordered alloy by means of perturbation theory in the limit of small mole fractions of all minority constituents of the alloy. Subject to certain approximations, the effects of all orders of perturbation theory upon the energy are determined. After introducing the pseudo quantum number k, it is shown that the expectation value of velocity and the effective mass are related to the energy in exactly the same fashion as is the case in the theory of energy bands of a perfect crystal. This pseudo quantum number k is in certain respects analogous to the ordinary k-vector of band theory. It is shown that alloying has a tendency to reduce effective masses and to reduce the anisotropy of surfaces of constant energy in k-space. As an example, a semiquantitative calculation is made of the dependence of the effective electron masses in germanium–silicon alloy upon alloy composition. In case there are localized bound impurity levels associated with any of the minority-constituent atoms in the host crystal, then the general analysis breaks down. It is shown that this results from the discontinuous nature of the energy (considered as a function of f, the mole fraction of the minority constituent) at f = 0, whenever a bound level is associated with this constituent. It is pointed out that the analysis of this paper corresponds to the determination of coherent scattering correctly to all orders of perturbation theory but does not include the effects of incoherent scattering. A.

539.11 : 548.736.1

1475. ON THE CRYSTAL STRUCTURE OF THE RARE GASES. R.U.Ayres and R.H.Tredgold.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 840-2 (Aug., 1956).

Theoretical. Describes an attempt to explain the preference of rare gases for the f.c.c. structure, despite the apparent lower energy of the h.c.p. structure given by previous theories (Abstr. 407, 2911, 4832/1955), in terms of three-body dipole-dipole-quadrupole forces. The attempt fails, as calculation shows that in argon, this effect favours the h.c.p. lattice by 0.3% of the cohesive energy. J.Hawgood

539.11 : 548.7

1476. ELECTRON THEORETICAL INVESTIGATIONS ON DEFECTS IN METALS. III. THE INFLUENCE OF DISLOCATIONS ON THE CRYSTAL DENSITY AND RELATED PROBLEMS. H.Stehle and A.Seeger.
Z. Phys., Vol. 146, No. 2, 217-41 (1956). In German.

For Pt II see Abstr. 6042 (1956). Reports results of a second-order elasticity treatment of the change of density of a crystal containing a screw dislocation. The scattering of quasi-free electrons by the dislocation is investigated. The perturbing potential contains a contribution from these second-order effects as well as from the dependence of the effective mass on the lattice distortions. E.P.Wohlfarth

539.11 : 537.311.31

1477. ELECTRON THEORETICAL INVESTIGATIONS ON DEFECTS IN METALS. IV. THE ELECTRICAL RESISTANCE OF DISLOCATIONS. A.Seeger and H.Stehle.
Z. Phys., Vol. 146, No. 2, 242-68 (1956). In German.

The electrical resistance of a screw dislocation is calculated for high and low temperatures, and Matthiessen's rule is found to be invalid. The change of density calculated in the preceding paper (see preceding abstract) is in good agreement with observation for Cu and Ni, but the calculated resistance change is too small compared with experiment for Cu. This discrepancy is discussed. E.P.Wohlfarth

MOLECULES 539.13

539.13

1478. TRANSITION PROBABILITY IN MOLECULAR ENCOUNTERS. II. VIBRATIONAL RELAXATION TIME IN METHANE. T.L.Cottrell and N.Ream.
Trans Faraday Soc., Vol. 51, Pt 11, 1453-65 (Nov., 1955).

For Pt I, see Abstr. 3922 (1955). The object of this work was to calculate the vibrational relaxation time in methane from fundamental theory. This involves calculating the probability of vibrational de-excitation for typical encounters between pairs of molecules and averaging over all encounters. The statistics of encounters and the most suitable approximate methods of averaging are discussed. The force acting between methane molecules at close range is investigated, and formulae are obtained for the intermolecular force in terms of the interatomic forces involved. The coupling between intermolecular force and the excitation of vibration is studied, and the concept of the effective vibrational mass of a polyatomic molecule is used as a measure of this coupling. Numerical values of relaxation time are obtained, and compared with experimental results. The order of magnitude of the calculated values is correct but the calculated temperature dependence is much too steep. Possible reasons for this discrepancy are examined, and it is noted that it is also characteristic of simpler solutions of the relaxation time problem. A.

539.13 : 535.375.5

INTERMOLECULAR INTERACTIONS IN CERTAIN NITRO COMPOUNDS. See Abstr. 277

539.132

1479. ON THE WEIZSÄCKER CORRECTION IN THE STATISTICAL THEORY OF MOLECULAR STRUCTURE. W.Kołos.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 3, 147-9 (1956).

Sheldon (Abstr. 8959/1955) solved the Thomas–Fermi equation for N_2, and concluded that the method does not lead to stability. The effect of the Weizsäcker correction on the N_2 molecule and the N atom is here computed. While binding is not obtained for either case, the repulsion energy is much smaller with this correction, suggesting that in numerical calculations like Sheldon's binding might result. J.Jacobs

539.132

1480. DISSOCIATION ENERGY OF FLUORINE. K.L.Wray and D.F.Hornig.
J. chem. Phys., Vol. 24, No. 6, 1271-2 (June, 1956).

This has been evaluated from a determination of the variation of the velocity of a shock wave in a mixture of F_2 and A with composition. It is found to be 31 kcal per mole. W.Good

539.132 : 535.343

1481. ROTATION-VIBRATION SPECTRA AND THE MOLECULAR CONSTANTS OF CYCLOPROPANE AND CYCLOPROPANE-d_6. H.H.Günthard, R.C.Lord and T.K.McCubbin, Jr.
J. chem. Phys., Vol. 25, No. 4, 768-74 (Oct., 1956).

The parallel fundamental infrared bands of cyclopropane at 3101 cm^{-1} and cyclopropane-d_6 at 2336 cm^{-1} have been studied at high resolution. The ground-state rotational constants B'', whose values are found to be 0.6696 ± 0.0028 and 0.4630 ± 0.0023 cm^{-1}, respectively, yield a value for the C–C distance of 1.524 ± 0.014 A and a functional relationship between the C–H distance and the HCH angle. If the C–H distance is assumed to be 1.07 A, the HCH angle appears to have

a value just above 120°. A normal-coordinate treatment yields force constants and eigenvectors for vibrations of species A_1', A_2'', E' and E''. Zeta constants of vibration-rotation interaction for species E' have been calculated for both cyclopropane and cyclopropane-d_6. A.

539.132

482. CHANGES OF ROTATIONAL CONSTANTS IN SOME Π–Σ ANDS OF HCN AND N_2O. D.H.Rank, T.A.Wiggins, A.H.Guenther nd J.N.Shearer.
. Opt. Soc. Amer., Vol. 46, No. 11, 953-6 (Nov., 1956).

The fact that certain rotational "constants" change with the ibrational state of the molecule is well known. It is also true that ie two substates of a Π state have slightly different values of rotaonal constants associated with them. The difference of the two B alues in a Π state is designated by q (usually of the order of 0^{-3} cm^{-1}), while the difference of the two D' values is called ($\sim 10^{-7}$ cm^{-1}). Measurements have been made of q and μ for the 1^11-000 band of HCN with the aid of a Fabry–Perot etalon which ad dielectric films for the reflecting surfaces. The method emloyed made it possible to ignore the effect of phase changes due to eflections in the etalon, and a crude optical calibration of the spacer as all that was necessary. In addition, $B_d' - B''$ and $D_d' - D''$ for ie Q branch of the 01^11-000 band of HCN and $B_d' - B''$ for branch of the 11^11-000 band of N_2O have been measured. The esults are:

1^11-000 of HCN; $q = 7.76 \times 10^{-3}$ cm^{-1}, $\mu = 20 \times 10^{-8}$ cm^{-1}
1^11-000 of HCN; $B_d' - B'' = -0.002\,876$ cm^{-1}, $D_d' - D'' = 9.4 \times 10^{-8}$ cm^{-1}
1^11-000 of N_2O; $B_d' - B'' = -0.004\,067$ cm^{-1}, $D_d' - D'' < 10^{-8}$ cm^{-1}.

esolution of 175 000 was obtained with the Q branch of the 01^11 band f HCN. Taking account of the finite slit width and the inevitable oppler line broadening, the resolution attained is shown to be 95% f that theoretically to be expected for the double passed grating ectrograph employed in this investigation. A.

539.132

1483. HINDERED ROTATION IN SYMMETRIC-ASSYMMETRIC MOLECULES. D.G.Burkhard.
Trans Faraday Soc., Vol. 52, Pt 1, 1-6 (Jan., 1956).

The wave equation is derived and solved for a molecule consisting of a symmetric and a completely asymmetric group undergoing mututal rotation about a common axis. The matrix elements are evaluated by making use of the commutation relations obeyed by the components of angular momentum. A.

539.132 : 535.343

1484. INFRA-RED BANDS AND ROTATIONAL CONSTANTS OF HCN AND DCN. I.R.Dagg and H.W.Thompson.
Trans Faraday Soc., Vol. 52, Pt 4, 455-63 (April, 1956).

Some vibration-rotation bands of hydrogen cyanide and deuterium cyanide have been measured with high resolution. In addition to lines in the P and R branches, those of the Q branch have been split up in some cases. Rotational constants B and D have been determined in the various vibrational levels. With hydrogen cyanide, the values α_1, α_2 and α_3 relating the rotational constants B in different vibrational states have been determined and $q_{010} = 0.0075$ cm^{-1}. The analysis of $3\nu_2$ for hydrogen cyanide leads to a value for $q_{030} = 0.0135$ cm^{-1} or 0.0153 cm^{-1}. An unresolved band with P/R maxima at 2093 cm^{-1} is attributed to dimeric hydrogen cyanide. From the band $(\nu_1 + \nu_2)$ of deuterium cyanide, α_2 has been determined. The derived molecular constants have been compared with previous data on these molecules. The bond lengths calculated are $r_e(CH) = 1.065$, $r_e(CN) = 1.153$ A, in agreement with earlier estimates of Douglas and Sharma. A.

539.132 : 535.343

UNCOUPLING EFFECTS IN THE MICROWAVE SPECTRUM OF NITRIC OXIDE. See Abstr. 1183

539.132

485. GEOMETRICAL STRUCTURE OF BENZENE-HALOGEN HARGE TRANSFER COMPLEXES. E.E.Ferguson.
. chem. Phys., Vol. 25, No. 3, 577-8 (Sept., 1956).

The infrared spectra (2-15 μ) of solutions of Br_2 and of I_2 in enzene differ from the spectrum of pure benzene in that bands at 50 and 992 cm^{-1} are appreciably enhanced in intensity. These ands correspond to E_{1g} and A_{1g} fundamentals which are inactive the infrared spectrum of benzene. It is concluded that the symetry of the benzene molecule in the $X_2 : C_6H_6$ complex has been educed from D_{6h} to C_{6v}. G.Allen

539.132 : 537.56

1486. INTERACTION ENERGY AND CHARGE EXCHANGE BETWEEN HELIUM ATOMS AND IONS. B.L.Moiseiwitsch.
Proc. Phys. Soc. A, Vol. 69, Pt 9, 653-8 (Sept., 1956).

In Pt I of this paper, the electronic energies for the $^2\Sigma_u$ and $^2\Sigma_g$ states of He_2^+ are calculated for a wide range of internuclear distances. In Pt II, the electronic energies are used to determine the cross-section for charge-exchange between He^+ ions and He atoms for ion energies ranging from 0.1 eV to 100 keV. Good agreement is obtained with the experimental results of Wolf and of Rostagni for ion energies between 100 eV and 1 keV, and also with the experimental results of Stedeford between 1 keV and 40 keV. A.

539.132 : 535.56

1487. RESONANCE OF PARAMAGNETIC FARADAY EFFECT IN $Cr_2(SO_4)_3$, $MnCl_2$ AND $CoCl_3$ AT 3.37 cm WAVELENGTH. P.Hedvig and Á.Nagy.
Acta phys. Hungar., Vol. 5, No. 4, 529-31 (1956).

The Faraday effect associated with the electron resonance of $MnCl_2$, $CoCl_3$ and $Cr_2(SO_4)_3.18H_2O$ was observed to invert in sign at g values of 1.84, 1.93 and 1.87 with maximum rotations of 5, 0.3 and 2.5 minutes/cm respectively using samples of powder in TE_{11} cylindrical guide. The $Cr_2(SO_4)_3.18H_2O$ gave an asymmetric curve of rotation against magnetic field indicating fine structure. D.H.Whiffen

539.132

1488. HYPERFINE STRUCTURE OF THE LINES OF THE PARAMAGNETIC RESONANCE IN COOLED SOLUTIONS OF V^{51++}, Cr^{53+++} AND Mn^{55++}. N.S.Garif'yanov.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 725-7 (1956). In Russian.

The paramagnetic resonance spectra of ethyl alcohol solutions of $Mn^{55}Cl_2$, $Cr^{53}(NO_3)_3$, $Cr^{52}(NO_3)_3$ and $V^{51}Cl_2$ were measured at 90°K at 520 Mc/s and lower frequencies down to 58 Mc/s. The low-field g values are in agreement with theory which gives

$$g_F = g_e [F(F + 1) + J(J + 1) - I(I + 1)]/[2F(F + 1)]$$

Mn^{55++} is in an $^6S_{5/2}$ state, and I = 5/2 and $g_F = 1.0$ as observed. For the $^4F_{3/2}$ state, as in Cr^{+++} and V^{++}, J is replaced by S since the orbital contribution is quenched. For Cr^{55+++} I = 3/2 and $g_F = 1$; the observed value falls from 3.0 at 520 Mc/s to 1.2 at 58 Mc/s. For Cr^{52+++} I = 0 and $g_F = 2$. For V^{51++} I = 7/2 and g_F is F-dependent; a broad line is observed at $g_F = 0.5$ (at 58 Mc/s) in accordance with expectation. D.H.Whiffen

539.132

1489. PARAMAGNETIC RESONANCE ABSORPTION IN COPPER HEXAPYRIDINE NITRATE. H.Abe and M.Ohtsuka.
J. Phys. Soc. Japan, Vol. 11, No. 8, 896 (Aug., 1956).

Electron resonance is found in $Cu(C_5H_5N)_6(NO_3)_2$ at both 6.5 mm and 3.23 cm. At both wavelengths the g tensor is axially symmetric with $g_{||} = 2.25 \pm 0.02$ and $g_\perp = 2.05 \pm 0.02$. There are four hyperfine lines due to the Cu with I = 3/2 for which $|A| = 190 \pm 5$ Oe and $|B| < 15$ Oe. D.H.Whiffen

539.132

1490. PARAMAGNETIC RESONANCE SPECTRA OF SOME CUPRIC SALTS. I. H.Abe and K.Ôno.
J. Phys. Soc. Japan, Vol. 11, No. 9, 947-56 (Sept., 1956).

The paramagnetic resonance spectra of some ammine, ethylenediammine and pyridine derivatives of hydrated cupric salts were examined, using their single crystals and microwaves of $\lambda = 32 \sim 5$ mm. In the cases of $[Cu(NH_3)_4]SO_4.H_2O$ and $[Cu(en)_2]Cl_2.xH_2O$, detailed analysis of spectra was performed using the structural data from X-ray analysis given by Mazzi. In the other cases, analysis was discussed under an assumption of inequivalent magnetic units. Results thus obtained are fully explained by the treatments given by Abragam and Pryce with modified λ, the spin-orbit coupling coefficient, so the forces acting between the central copper ion and the surrounding nitrogen atoms are supposed to be mainly ionic rather than covalent, as usual in hydrates. Exchange energies between copper ions are also discussed. A.

539.132

1491. RELAXATION TIMES T_1 AND T_2 IN ANTHRACITE. N.S.Garif'yanov and B.M.Kozyrev.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1160 (1956). In Russian.

Measurements at 12.25 and 22 Mc/s on the electron resonance gave for $\alpha\alpha$-diphenyl-β-picrylhydrazyl $T_1 = 6.6 \times 10^{-8}$ and $T_2 = 6.0 \times 10^{-8}$ sec. For Kuzbassk anthracite $T_1 = 12 \times 10^{-8}$ and $T_2 = 11.4 \times 10^{-8}$ sec. D.H.Whiffen

539.132 : 535.58

MOLECULAR EXCITATION AND ANOMALOUS LIGHT DISPERSION IN DYES. See Abstr. 1217

539.132

1492. FINE SPLITTINGS IN THE NUCLEAR MAGNETIC RESONANCE SPECTRA OF ALKYL DERIVATIVES. R.E.Glick and A.A.Bothner-By.
J. chem. Phys., Vol. 25, No. 2, 362-3 (Aug., 1956).

Spin-spin separations have been determined for a series of 30 ethyl and isopropyl derivatives. Alteration of nonmagnetically active substituents within the molecule causes little interaction, whereas the introduction of a new magnetically active nucleus may completely change the nuclear interaction functions. G.I.W.Llewelyn

539.132 : 535.343

HYPERFINE STRUCTURE IN THE SPECTRUM OF HCN. See Abstr. 1184

539.132

1493. THE BINDING ENERGY OF THE NITROGEN MOLECULE. A.C.Hurley.
Proc. Phys. Soc. A, Vol. 69, Pt 10, 767-76 (Oct., 1956).

A recent self-consistent field molecular orbital calculation on the nitrogen molecule by Scherr is extended to include configuration interaction. In this way the calculated binding energy D_e is increased from 1.19 electron volts to 3.29 electron volts. The extended calculation is then modified to make allowance for the effects of intra-atomic electron correlation. The result of this modified calculation ($D_e > 9.18 \pm 0.5$ eV) is consistent only with the higher of the two spectroscopic values (7.52, 9.91 eV). Configuration interaction is much less important in the modified calculation than in the orbital calculation. A.

539.132

1494. ORBITAL FOLLOWING AND LONE PAIR ELECTRONS IN THE AMMONIA MOLECULE. N.V.Cohan and C.A.Coulson.
Trans Faraday Soc., Vol. 52, Pt 9, 1163-72 (Sept., 1956).

A simple potential function is devised to account for the eight fundamental frequencies in NH_3 and ND_3. This function is interpreted as implying that when the bonds are displaced from their equilibrium directions there is partial following of the hybrid atomic orbitals used in forming the bonds. Interactions with the lone-pair electrons are essential, and the change of dipole moment in the symmetrical ν_2 vibration is rather more than half due to hybridization changes in these lone-pair electrons. The agreement with total dipole moment and absolute intensity of absorption is satisfactory. A.

539.132

1495. SOME CONSEQUENCES OF ORTHOGONALIZATION IN MOLECULAR-ORBITAL THEORY. C.A.Coulson and G.R.Lester.
Trans Faraday Soc., Vol. 51, Pt 12, 1605-11 (Dec., 1955).

A numerical study is made, particularly for H_2^+, of the effects of neglecting orthogonality between various atomic orbitals in the construction of molecular orbitals. Calculated dissociation energies are seriously affected though some are less sensitive than others. The Pauling strength criterion for hybrid orbitals of s, p type is shown to be reasonably (though not completely) valid, despite the fact that both previous discussions of it are inadequate. Comparison with completely accurate wave-functions shows that when orthogonality between 2- and 1-quantum molecular shells and also s, p hybridization is permitted, the l.c.a.o. molecular orbitals give a surprisingly accurate energy. No calculations of transition intensities are of any value without these refinements. A.

ATOMS. NUCLEUS. ISOTOPES 539.15

539.15

1496. CALCULATION OF RETARDATION IN THE INTERACTION OF NEUTRAL ATOMS. I.E.Dzyaloshinskiĭ.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1152-4 (1956). In Russian.

Interaction between two neutral hydrogen atoms is calculated by perturbation theory and found proportional to R^{-7}, where R is the interatomic distance. G.E.Brown

539.152.1

1497. SHELL MODEL AND COLLECTIVE MOTIONS. J.Yoccoz.
J. Phys. Radium, Vol. 17, No. 7, 517-18 (July, 1956). In French.

A variational method, first proposed by Hill and Wheeler, is used for the description of the collective motions of the nuclei. The results, for the relation between the moment of inertia and the deformation, are better than those obtained with the hydrodynamic model. A.

539.152.1 : 530.145

1498. THE NEUTRON–PROTON SYSTEM WITH A CENTRAL EXPONENTIAL POTENTIAL. II. P.-O.Brundell and B.Enander.
K. Tekn. Högsk. Handl., No. 92, 13 pp. (1956).

For Pt I, see Abstr. 11319 (1954). The interaction between a neutron and a proton in the ^3S- and the ^1S-state is assumed to be described by a central potential of the form $-Be^{-\lambda r}$. It is further assumed that the range of the potential, $1/\lambda$, is the same in these two states but that the depth is different: B_t and B_s. The potential parameters $1/\lambda$, B_t, and B_s are assumed to have the values determined in Pt I. The interaction in higher states as well as quadrupole and exchange effects are neglected. Under these assumptions the photoelectric and photomagnetic cross-sections σ_e and σ_m of the system are calculated for some energies up to 17 MeV. σ_e is determined exactly and σ_m is calculated by a slightly improved method originally used by Bethe and Longmire (Bethe 1950). Comparison is made with experimental values. A.

539.152.1

1499. NUCLEAR SURFACE EFFECTS. D.P.Hale and R.D.Present.
Phys. Rev., Vol. 104, No. 2, 448 (Oct. 15, 1956).

The nuclear surface energy and surface thickness have been calculated from a model in which the assumed volume energy density is a simple empirical function of the particle density and the particle density is a simple empirical function of position. Weizsäcker's inhomogeneity correction has been used in unmodified form. For various combinations of empirical energy densities (leading to reasonable compressibilities) with empirical particle densities, the calculated surface energies were found to agree within 15% with the surface energy term of the semiempirical mass formula. The calculated surface thicknesses exceed by 20 to 60% the surface thickness of the proton distribution inferred from electron scattering experiments. A.

539.152.1 : 537.533.74

THE SHELL MODEL OF LIGHT NUCLEI. See Abstr. 1374

539.152.1 : 539.155.1

NUCLEAR BINDING ENERGIES OF THE STABLE ISOTOPES OF Fe, Co, Ni, Cu AND Zn. See Abstr. 1527

539.152.1 : 539.172.3

TWO-BODY MODEL OF Li^7 NUCLEUS. See Abstr. 1610

539.152.1

1500. NUCLEAR CHARGE DENSITY DISTRIBUTIONS. M.K.Advani, P.Harihar and K.M.Gatha.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 650-1 (Aug., 1956).

The nuclear scattering of Dirac electrons has been calculated on the basis of a Fermi and a modified gaussian nuclear charge distribution, and the results compared with experimental observations of the scattering of 183 MeV electrons from middle and heavy elements. It was found that the differential scattering cross-sections could best be described in terms of the modified gaussian charge density distribution. D.R.Chick

539.152.1 : 530.145

1501. MEASUREMENTS OF CONVERSION ELECTRONS FROM COULOMB EXCITATION OF THE ELEMENTS IN THE RARE EARTH REGION. T.Huus, J.H.Bjerregaard and B.Elbek.
K. Danske Vidensk. Selsk., mat-fys. Medd., Vol.30, Paper 17, 72 pp. (1956).

Deals with the experimental problems connected with measurements of the conversion electrons produced by Coulomb excitation of the heavier elements. It contains the results of a series of measurements on elements with the atomic numbers 25, 26, 47, 60, 62 to 75, and 77 to 79. Reduced transition probabilities are computed from the data and are compared with the results derived from lifetime measurements. By means of the unified model, nuclear moments are calculated

from the measured excitation energies and transition probabilities. The values obtained are compared with the theory as well as with other experimental evidence and in general the agreement is found to be satisfactory. A.

539.152.1

1502. ON THE EXACT EVALUATION OF THE COULOMB EXCITATION. K.Alder and A.Winther.
K. Danske Vidensk. Selsk., mat-fys. Medd., Vol. 29, Paper 19, 19 pp. (1955).

It is shown that the calculation of the total cross-section for Coulomb excitation can be reduced to the calculation of radial matrix elements between eigenstates in the Coulomb potential. With the method developed in a preceding paper (Abstr. 9440/1955), one is able to give closed expressions, convenient series expansions, and recursion formulae for these matrix elements. The case of vanishing energy loss and the semi-classical limit are also discussed. A.

539.152.1

1503. THE EXCITED LEVELS OF DEFORMED NUCLEI. N.Marty.
J. Phys. Radium, Vol. 17, No. 7, 521-5 (July, 1956). In French.

Short review of the conditions of existence and properties (energy and spin) of the excited levels due to rotational motion: (a) even–even nuclei; (b) odd nuclei. Structure of particle levels in deformed nuclei, evidence of E_1 transitions. A.

539.152.1

1504. EXCITED STATES OF $_2He^6$. D.Magnac-Valette and P.Cüer.
J. Phys. Radium, Vol. 17, No. 7, 553-4 (July, 1956). In French.

The authors tried to obtain different excited levels in He^6 by triton-induced reactions in Li^7. Two methods have been applied, one sending a triton beam of 0.84 MeV obtained with ionized tritium on a lithium target and using a photographic plate as a detector, the other by sending outgoing tritons from reaction $Be^6(d,t)Be^8$ on a lithium-loaded plate. Excited levels at 1.71 MeV (decaying by γ) and 9.3 MeV (decaying by α) have been found. There is some evidence for a state around 6 MeV with a very weak probability. Comparison is made with Chalk River results (Allen and coworkers). Cross-sections for ground state and first excited levels are given at 0.84 MeV and 90^0. A.

539.152.1

1505. SOME INFORMATION ABOUT THE WEAKLY EXCITED LEVELS OF Be^8 AND Li^7 OBTAINED BY THE REACTIONS $Be^9(d,\alpha)Li^{7*}$, $Be^9(d,t)Be^{8*}$. J.J.Jung and P.Cüer.
J. Phys. Radium, Vol. 17, No. 7, 555-6 (July, 1956). In French.

These competitive reactions allow evidence to be obtained about low-lying excited states for Be^8 and Li^7. The question is of interest in connection with the models of these two nuclei. These disintegrations are extended to 3.5 MeV with the help of the Saclay Van de Graaff setup. The emitted particles are magnetically separated and collected in nuclear E_1 emulsions. A histogram of 8000 triton tracks at 30^0 shows clearly the well known broad 2.8 MeV state of Be^8. The continuum ends show the $\alpha + t$ transitions of the 4.6 (narrow) and 6.6 MeV (broad) states of Li^7. No other excited state is formed for Li^7. A somewhat indefinite peak at 2.2 MeV for Be^8 indicates that a further study on this point would be worthwhile. A.

539.152.1

1506. THE FIRST LEVELS OF F^{18}. V.Naggiar, M.Roclawski-Conjeaud, D.Szteinsznaider and J.Thirion.
J. Phys. Radium, Vol. 17, No. 7, 561 (July, 1956). In French.

The analysis of neutrons and gamma from the reaction $O^{18}(p,n)F^{18*}$ confirms an already known 1050 ± 20 keV level for F^{18}. A 950 ± 15 keV level is revealed. A.

539.152.1

1507. FIRST EXCITED STATES OF HEAVY EVEN-EVEN NUCLEI. J.M.Hollander.
Phys. Rev., Vol. 103, No. 5, 1590-1 (Sept. 1, 1956).

Detailed examination of the energies of these excited states for U, Pu and Cm ($A \geq 230$) indicates that they do not decrease monotonically with N or A. Although fragmentary, the measurements allow of examination of very small changes in nuclear deformation by the addition of pairs of nucleons to an already deformed core. A.O.Stanesby

539.152.1 : 539.172.13

1508. MEASUREMENT OF ENERGY LEVELS IN F^{19} AND O^{16}. G.L.Squires, C.K.Bockelman and W.W.Buechner.
Phys. Rev., Vol. 104, No. 2, 413-15 (Oct. 15, 1956).

The broad-range magnetic spectrograph of the Massachusetts Institute of Technology has been used to study the proton groups from the reaction $F^{19}(p,p')F^{19*}$ and the alpha-particle groups from the reaction $F^{19}(p,\alpha)O^{16*}$. The incident protons had an energy of 7 MeV and were produced by a Van de Graaff generator. The ground-state Q value for the $F^{19}(p,\alpha)O^{16}$ reaction was found to be 8.110 ± 0.010 MeV. Values of the energy levels of F^{19} and O^{16} are given up to 4.05 and 11.3 MeV, respectively. A.

539.152.1

1509. ENERGY LEVELS OF Be^9. C.K.Bockelman, A.Leveque and W.W.Buechner.
Phys. Rev., Vol. 104, No. 2, 456-60 (Oct. 15, 1956).

Magnetic analysis of the alpha-particle groups from the deuteron bombardment of boron and of the proton groups from the proton bombardment of beryllium confirms previous work indicating the existence of levels in Be^9 at 2.43 and 3.04 MeV. The energy of the edge of a broad distribution at 1.664 MeV excitation is taken to indicate that it arises from a three-body reaction; the shape of the edge indicates the influence of the Be^8–n interaction. A.

539.152.1

1510. REPULSION OF NUCLEAR LEVELS. I.I.Gurevich and M.I.Pevzner.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 162-4 (1956). In Russian.

If levels were randomly spaced, then the probability $W(\epsilon)$ of a distance ϵ between levels would be $W = [\exp(\epsilon/D)](d\epsilon/D)$, where D is the average spacing. In fact, experimental data for heavy elements show fewer levels with small ϵ than predicted by this curve. G.E.Brown

539.152.2 : 539.166

1511. A POSSIBLE METHOD FOR THE DETERMINATION OF THE SIGN OF THE QUADRUPOLE MOMENT OF Cd^{111}. R.Omnes.
J. Phys. Radium, Vol. 17, No. 7, 528-9 (July, 1956). In French.

The angular correlation of polarized gamma-rays in a nuclear cascade gives the sign of quadrupolar moment. A.

539.152.2

1512. SPINS OF RUBIDIUM ISOTOPES OF MASSES 81, 82, 83, AND 84. J.P.Hobson, J.C.Hubbs, W.A.Nierenberg, H.B.Silsbee and R.J.Sunderland.
Phys. Rev., Vol. 104, No. 1, 101-6 (Oct. 1, 1956).

The nuclear spins of four neutron-deficient isotopes of rubidium have been determined by the atomic-beam magnetic-resonance method. The isotopes, with half lives between 4.7 hours and 80 days, are produced in quantities of 10^{13} to 10^{14} atoms by alpha spallation reactions in the Berkeley 60 inch cyclotron. Detection of the beam is accomplished by allowing the neutral beam to fall on a sulphur surface at room temperature, then removing the surface from the apparatus and counting with low-background high-efficiency scintillation counters which accept K X-rays accompanying K capture and internal conversion. Since all four isotopes are made in one bombardment, the identification is important (and is the subject of a separate discussion). The experimental results are: Rb^{81}, $I = 3/2$; Rb^{82}, $I = 5$; Rb^{83}, $I = 5/2$; Rb^{84}, $I = 2$. A.

539.152.2

1513. MAGNETIC MOMENT OF THE SECOND EXCITED STATE OF F^{19}. P.Lehmann, A.Leveque and R.Pick.
Phys. Rev., Vol. 104, No. 2, 411-12 (Oct. 15, 1956).

The perturbation of the angular distribution of the 197 keV gamma-rays following inelastic scattering of protons in F^{19} has been measured as a function of an external magnetic field and the magnetic moment of the 197 keV state has been extracted from these measurements. A value of $+(3.70 \pm 0.45)$ nuclear magnetons has been found. The lifetime of this state has been determined precisely: $\tau = (1.23 \pm 0.07) \times 10^{-7}$ sec. A.

539.152.2

1514. THE MAGNETIC MOMENTS OF ODD–ODD NUCLEI. C.A.Caine.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 635-9 (Aug., 1956).

The considerations of simple configurational mixing, used previously to account for the deviations of the magnetic moments of odd nuclei from the Schmidt lines (Abstr. 11325/1954), are extended to give a theoretical basis to Schwartz' empirical rule (Abstr. 4283/1953). P.T.Matthews

539.152.2 : 539.153

1515. ISOTOPE EFFECTS IN THE HYPERFINE STRUCTURE OF THE RESONANCE LINES OF GALLIUM I. D.A.Jackson.
Phys. Rev., Vol. 103, No. 6, 1738-9 (Sept. 15, 1956).

The hyperfine structure of the lines 4033 and 4172 A of gallium I has been investigated by means of the absorption of a multiple atomic beam of high collimation. From the measurements of the structure of the line 4033 A are derived: the h.f.s. intervals of the terms $4\ ^2P_{1/2}$ and $5\ S_{1/2}$ for Ga^{69} and Ga^{71}, the ratio of the nuclear magnetic moments, and the isotope shift; and from the line 4172 A, the h.f.s. intervals of the term $4\ ^2P_{3/2}$ of Ga^{69} and Ga^{71}, and hence an approximate value for the quadrupole moment coupling factors for the two isotopes. A.

539.152.2

1516. SAMPLE SPINNING AND FIELD MODULATION EFFECTS IN NUCLEAR MAGNETIC RESONANCE. G.A.Williams and H.S.Gutowsky.
Phys. Rev., Vol. 104, No. 2, 278-83 (Oct. 15, 1956).

Sideband resonances have been observed in high-resolution nuclear magnetic resonance experiments in which a cylindrical sample is rotated in a magnetic field with a linear gradient. It is shown that these sidebands arise in a manner similar to the sidebands observed when the magnetic field is modulated by an external source. The general question of time-dependent local magnetic fields is considered and the effects of coherent fluctuations are compared with those of random fluctuations for several simple models. A.

539.152.2

1517. RADIATION DAMPING AND RESONANCE SHAPES IN HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE. C.R.Bruce, R.E.Norberg and G.E.Pake.
Phys. Rev., Vol. 104, No. 2, 419-20 (Oct. 15, 1956).

An analysis of a nuclear spin-resonant circuit system shows that the electric circuit parameters rather than the nuclear spin relaxation times may determine resonance widths, maximum signal, and integrated intensities in high-resolution continuous-wave nuclear magnetic resonance. A.

539.153

1518. THE PHOTO-IONIZATION CROSS SECTION OF NEUTRAL ATOMIC CALCIUM. M.J.Seaton.
Ann. Astrophys., Vol. 18, No. 3, 206-10 (1955).

A discrepancy between the cross-section calculated by Bates and Massey using exchange wave functions and that measured by Jutsum is attributed to configuration interaction effects. An approximate formula is obtained for the cross-section in terms of the phase $\delta(k^2)$ of the 4s $k^2p\ ^1P$ continuum radial function. Denoting the quantum defects for the 4s np ^1P series by $\mu(n)$ it is shown that the measured cross-section is consistent with the relation $\pi\mu(\infty) = \delta(0)$. The cross-section at higher energies, required for the study of interstellar ionization equilibrium, is estimated using a linear extrapolation of the phases found to be consistent with the measured cross-section at lower energies. A.

539.153

1519. ON A STATISTICAL ATOM MODEL, IN WHICH THE ELECTRONS ARE GROUPED ACCORDING TO THE PRINCIPAL QUANTUM NUMBER. P.Gombás and K.Ladányi.
Acta phys. Hungar., Vol. 5, No. 3, 313-23 (1955). In German.

By grouping the electrons according to the principal quantum number a statistical atom model is developed in which the method of electron density produces characteristic maxima in place of the electron shells. The distribution of electron density is calculated for Ne, A, Kr, and Xe atoms as well as for the Rb^+ ion. The results are in good agreement with those of the "self-consistent field". D.J.A.Prowse

539.153

1520. PARAMAGNETIC RESONANCE REORIENTATION OF ATOMS AND IONS ALIGNED BY ELECTRON IMPACT. H.G.Dehmelt.
Phys. Rev., Vol. 103, No. 4, 1125-6 (Aug. 15, 1956).

Reports paramagnetic resonance absorption measurements on Hg atoms excited to the $^3P_2$ state by electron impact. E.P.Wohlfarth

539.153

1521. MEAN LIFE OF THE $^3P_2$ METASTABLE ARGON LEVEL. A.H.Futch and F.A.Grant.
Phys. Rev., Vol. 104, No. 2, 356-61 (Oct., 15, 1956).

Using a previously described light-absorption technique, the mean life of the metastable $^3P_2$ level of argon has been measured in pure argon as a function of pressure at 77°K, and in mixtures of neon and argon at 300°K. The coefficient of diffusion of metastable argon atoms in the parent gas falls much more rapidly with decreasing temperature than the $T^{3/2}$ dependence predicted using the hard-sphere model. The cross-section for the quenching of metastable atoms by two-body collisions with normal atoms changes slightly with temperature, in a manner inconsistent with the assumption of collision-induced transitions to the radiating $^3P_1$ level. As the temperature is reduced from 300°K to 77°K, the frequency of quenching by three-body collisions increases from $13.5p^2$ to $440p^2$ sec^{-1} (mm of Hg)^2. At a given total pressure, the two-body quenching collision cross-section is much reduced and the three-body quenching collisions disappear as the ratio of partial pressures of neon to argon is increased. A.

539.153.4

1522. THE CALCULATION OF THE ELECTRON DENSITY DISTRIBUTION OF THE O^{2-}-IONS BY THE VARIATIONAL METHOD. R.Gáspár and P.Csavinszky.
Acta phys. Hungar., Vol. 6, No. 1, 125-32 (1956). In German.

The existence and stability of O^{2-}-ions in bound and free states are discussed. Eigenfunction approximations of the Morse—Young—Haurwitz type are considered and the radial distribution of electron density is computed. The total energy of the ions was calculated by means of Fock's energy equation. The energies calculated by the M.Y.H. method are a little higher than those calculated by Slater's method. D.J.A.Prowse

539.153.4

1523. STUDIES OF ATOMIC SELF-CONSISTENT FIELDS. ANALYTIC WAVE FUNCTIONS FOR THE ARGON-LIKE IONS AND FOR THE FIRST ROW OF THE TRANSITION METALS. P.O.Löwdin and K.Appel.
Phys. Rev., Vol. 103, No. 6, 1746-55 (Sept. 15, 1956).

An improved method for calculating analytic approximations to the self-consistent-field (SCF) functions is developed. The numerically given function is divided by a polynomial having the same nodes as the function, and the monotonically decreasing quotient is then expressed as a sum of exponentials. An exact method for expanding an arbitrary function into exponentials is discussed, but the results turn out to be extremely sensitive even to rounding-off errors. For practical purposes a method of successive approximation is used instead; it works inwards from the tail towards the origin and, in each step, two exponentials are simultaneously determined. Applications are carried out to the argon-like ions (Cl^-, A, K^+, Ca^{+2}) and to the copper ion. By expressing a SCF function $f_{nl}(r)$ in terms of (n + 1) exponentials, the error may be brought below the order of magnitude 0.001-0.002. By using the data available for Ca^+ and Cu^+, analytic wave functions have finally been interpolated for the first row of the transition metals (Sc, Ti, V, Cr, Mn, Fe, Co, Ni); the degree of accuracy is discussed. A.

539.154 : 538.245

1524. ATOMIC MAGNETIC MOMENTS OF FERROMAGNETIC METALS AND ALLOYS. F.M.Gal'perin.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 150-2 (1956). In Russian.

Empirical formulae are given for the quantitative calculation of the atomic magnetic moments of transition metals and alloys. Expressions are also given for the Curie point and its shift with pressure. Tables show comparisons with published experimental data. J.B.Arthur

539.154.3

1525. THE QUADRUPOLE MOMENT OF A HYDROGEN ATOM IN A UNIFORM FIELD. A.D.Buckingham, C.A.Coulson and J.T.Lewis.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 639-41 (Aug., 1956).

Successive terms in a perturbation expansion of the effects of a proton's field on a hydrogen atom are interpreted in terms of various multipole polarizabilities. G.E.Brown

539.154.3

1526. THE QUADRUPOLE POLARIZABILITY OF THE HYDROGEN ATOM. C.A.Coulson and M.J.Stephen.
Proc. Phys. Soc. A, Vol. 69, Pt 10, 777-82 (Oct., 1956).

The quadrupole moment of a hydrogen atom in a general state induced by a uniform electric field has been evaluated to second powers of the field strength. It is also shown that a uniform magnetic field may induce an electrical quadrupole moment and this has been calculated for the lowest two states of the hydrogen atom. A.

539.155.1 : 539.152.1

1527. ATOMIC MASSES IN THE REGION FROM IRON TO ZINC. K.S.Quisenberry, T.T.Scolman and A.O.Nier.
Phys. Rev., Vol. 104, No. 2, 461-70 (Oct. 15, 1956).

The large double-focusing mass spectrometer recently constructed at this laboratory has been used to measure the atomic masses of the stable isotopes of iron, cobalt, nickel, copper and zinc. Except in the cases of nickel and copper, the new masses agree reasonably well with the results of previous investigations. The isotopic assignment of neutron-capture γ-rays in the above elements has been examined using the new data and several new (n,γ) reaction Q-values result. Comparison between measured stable isotope mass differences and the mass differences calculated from nuclear disintegration energies shows no outstanding discrepancy in this region, assuming the new (n,γ) assignments to be correct. From nuclear energy data a complete mass table has been calculated for these five elements and the resulting masses used to investigate nucleon binding energies. The binding energy of the last proton or last neutron in the nucleus shows a reasonably consistent variation with mass. Pairing energies for the last neutron and last proton pairs have also been calculated wherever sufficient mass data exist. Only partial correlation seems possible between pairing energy and the angular momentum of the level occupied by the pair. A.

539.155.1

1528. THE MASSES OF THE LIGHT NUCLIDES (A REVIEW OF NUCLEAR PHYSICS DATA). J.Mattauch, L.Waldmann, R.Bieri and F.Everling.
Z. Naturforsch., Vol. 11a, No. 7, 525-48 (July, 1956). In German.

The voluminous data on reaction energies is investigated. The material is systematically presented in very great detail. The values are then used to calculate the masses of the 70 light nuclides up to Cl^{36}. This involved solving 70 linear equations with 70 unknowns. The results are presented in a matrix form. The discrepancies which still exist are discussed and compared with recent mass-spectrographic measurements. D.J.A.Prowse

539.155.2 : 551.49 : 551.577

1529. THE DETERMINATION OF TRITIUM IN NATURAL WATERS. R.M.Brown and W.E.Grummitt.
Canad. J. Chem., Vol. 34, No. 3, 220-6 (March, 1956).

A study of the tritium content of rain- and sea-water samples collected during the past several years has been made. The tritium in 100-2000 g samples was concentrated 2000 to 20 000 fold by electrolysis and the final concentrate counted as hydrogen in a Geiger counter. Good counter characteristics were obtained at hydrogen pressures up to one atmosphere by the use of an electronic quench unit of suitable deadtime in addition to the internal quench gas, ethylene. Rain and snow samples collected at Ottawa over the period 1951-1953 were found to range from 17.1 to 42.0 tritium atoms per 10^{18} hydrogen atoms, averaging 26.6. Tritium values for Ottawa rain-water for 1954 showed marked effects of the thermonuclear tests in the Pacific in the spring of that year, rising 10 to 100 fold during the test period, then gradually returning to normal, demonstrating a half time for washout of 35 days. The average tritium concentration of the year's rain is estimated to be 260×10^{-18} T/H. Surface sea-water samples collected at widely separated sites in the latter half of 1954 and early 1955 showed tritium concentrations in the range $3.0\text{-}4.2 \times 10^{-18}$ T/H, a value which corresponds with the amount of artificially produced tritium observed in Ottawa rain. Subsurface samples collected at one station off the coast of Nova Scotia in mid-1955 showed an unexpected concentration level and pattern, having a T/H value of 32.4×10^{-18} at the bottom depth of 600 ft., diminishing to a value of 5.4×10^{-18} at the surface. This is not thought to be a result of thermonuclear testing and warrants further investigation. A.

539.155.2

1530. THE NATURAL ABUNDANCES OF THE URANIUM ISOTOPES. M.Lounsbury.
Canad. J. Chem. Vol. 34, No. 3, 259-64 (March, 1956).

Using a surface-ionization mass spectrometer, the natural U^{238}/U^{235} abundance ratio in uranium obtained from Great Bear Lake Pitchblende has been measured to be 137.80 ± 0.14. From a survey of results reported in the literature on U^{234} a best value of $17\,325 \pm 550$ was estimated for the natural U^{238}/U^{234} abundance ratio. The corresponding isotopic abundances are 0.7204 ± 0.0007 atom % and $0.005\,73 \pm 0.000\,18$ atom % for U^{235} and U^{234}, respectively. A.

539.155.2

1531. THE DETERMINATION OF THE CHARACTERISTIC CONSTANTS OF SO_2 FOR THE SEPARATION TUBE PROCESS. H.Wullkopf.
Z. Phys., Vol. 146, No. 3, 389-92 (1956). In German.

In conjunction with a theory by David (Abstr. 6189/1953) the following data were obtained at a pressure of 1 atmosphere in the separation tube. Characteristic radius: 0.25 cm; length: 870 cm; transport: 1.2 cm^3/day. Power consumption 0.58 W/cm. Average thermal diffusion coefficient $\alpha \cong 0.22 \times 10^{-3}$. The results show that for an enrichment up to 80% of S^{34} about 180 metres of separation tube would be required using 15 kW of power and that after a year's operation 1.8 cm^3/day of enriched gas could be withdrawn. H.C.Cole

RADIOACTIVITY. α-, β- AND γ-RAYS 539.16

539.16.08

1532. THE RAPID DETECTION AND CONTINUOUS MONITORING OF RADIO-ACTIVE CONTAMINATION ON DUST IN LABORATORY AIR. K.E.G.Perry.
Atomic Energy Res. Establ. (Harwell) Rep. No. EL/R 1753, 34 pp. (1955).

This report summarizes the work accomplished towards the development of instruments for the continuous monitoring and rapid detection of airborne particulate radioactive contamination. As the permissible level of Pu^{239} constitutes the most serious hazard the major part of the development has been towards the rapid detection of low levels of alpha-activity but beta-measuring instruments have also been developed. As some of the development is still proceeding this is not intended to be a final report, but the results so far obtained and the trend of present development are presented. A.

539.16.08

1533. DISINTEGRATION-RATE DETERMINATION BY 4π-COUNTING. III. ABSORPTION AND SCATTERING OF β RADIATION. B.D.Pate and L.Yaffe.
Canad. J. Chem., Vol. 33, No. 11, 1656-68 (Nov., 1955).

For Pt II, see Abstr. 6412 (1955). The "coincident discharges" in a 4π-counter have been examined and found to be due in the main to gas and wall back-scattering. This can be resolved into two components — scattering near to and far from the source. Curves have been obtained for the back-scattering of β-radiation by the source-mounting film and for the absorption of the incident and back-scattered radiation. Back-scattering by the film is shown to be great enough to introduce a large error into the "sandwich" method which is currently in use for correcting for source-mount absorption. A.

539.16.08

1534. DISINTEGRATION-RATE DETERMINATION BY 4π-COUNTING. IV. SELF-ABSORPTION CORRECTION: GENERAL METHOD AND APPLICATION TO Ni^{63} β-RADIATION. B.D.Pate and L.Yaffe.
Canad. J. Chem., Vol. 34, No. 3, 265-74 (March, 1956).

A method of preparing thin uniform sources of radioactive materials for use in a 4π counter is described. The radioactive nuclides are formed into organic compounds and are subsequently distilled on to thin VYNS films. Electron microscope photographs of the deposits are shown. The material is uniformly deposited in crystals of about 1 μ in diameter. The distillation can be rendered quantitative.

The amount of material on the film can be estimated either spectrophotometrically in situ or by appropriate chemical means. Using this method a self-absorption curve for Ni^{63} (maximum beta energy 67 keV) is obtained. A.

539.16.08

1535. CALCULATION OF RESOLUTION CURVES OF COINCIDENCE SYSTEMS USING SCINTILLATION DETECTORS. L.Dick, R.Foucher, N.Perrin and H.Vartapetian.
J. Phys. Radium, Vol. 17, No. 7, 583-4 (July, 1956). In French.

Theoretical shapes of resolution curves for slow–fast coincidence circuits are calculated taking into account fluctuations in transit time and delay in the apparition of the first photoelectron in the photomultiplier tube. Comparison is made with experimental results. A.

539.16.08

1536. APPLICATION OF A STATISTICAL CORRELATION FUNCTION FOR DETERMINING DAUGHTER HALF-LIVES IN THE RANGE 10^{-4} TO 10^{-1} SECOND. M.D.Petroff and W.O.Doggett.
Rev. sci. Instrum., Vol. 27, No. 10, 838-43 (Oct., 1956).

Discusses the application of a statistical correlation method (Goldanski and Podgoretski, Abstr. 9905/1955) to the determination of the lifetime of an activity in equilibrium with a long-lived parent activity. It is shown that this method has a definite advantage over delayed-coincidence methods when the lifetime to be measured is of the order of 10^{-4} sec or longer. An electronic apparatus designed to perform the operations required by the statistical correlation method is described. This equipment has been used for a new determination, $0.293 \pm 0.020 \times 10^{-3}$ sec, for the half-life of Y^{88m}. A.

539.163

1537. SHORT-PERIOD ISOMERS PRODUCED BY PROTON BOMBARDMENT. O.I.Leĭpunskiĭ, V.V.Miller, A.M.Morozov and V.A.Yampol'skiĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 5, 935-7 (1956). In Russian.

Gamma-rays from targets exposed to a pulsed 20 MeV proton beam were detected by a scintillation counter and displayed on a fast oscilloscope. Millisecond activities were measured from Ta, Pb, Bi, Ti, Cd and Tl targets and the specific reactions identified for the first three. Others were detected with Cu, Mo and CaO, but not with Co, Rh and Au targets. W.O.Lock

539.163

1538. L ELECTRON CAPTURES AND K FLUORESCENCE YIELDS. DISCUSSION OF THE LATEST EXPERIMENTAL RESULTS. J.Laberrigue-Frolow, P.Radvanyi and M.Langevin.
J. Phys. Radium, Vol. 17, No. 7, 530-1 (July, 1956). In French.

Discussion of the L/K capture ratio measurements and their dependence on the K fluorescence yield R_K. Measurements of R_K were made on Tc^{99*} and In^{115*}. A new semi-empirical curve of R_K as function of Z was calculated. With the new values of R_K the reported discrepancies between experiments and theory become smaller but remain still important. A.

539.163

1539. RADIOACTIVITY OF Gd^{159}. STUDY OF THE EXCITED STATES OF Tb^{159}. R.Ballini and R.Barloutaud.
J. Phys. Radium, Vol. 17, No. 7, 534-5 (July, 1956). In French.

A γ transition of 222 keV in Tb^{159} is coincident with two transitions, probably the 81 and 58 keV previously known. A very weak transition of about 300 keV is also observed. The ratio of α_K coefficients of these two transitions and the relative intensities of 364, 222 and about 300 keV γ(100-2.5-0.5) are roughly measured. These intensities are in discordance with the calculated branching ratios (Alaga et al.) if these three transitions have the same initial state (hypothesis compatible with the measured energies). The mean life of 364 keV state is $\leq 5 \times 10^{-10}$ sec. The 58 keV transition is chiefly in coincidence with a β spectrum of about 950 keV. A.

539.163.1

1540. A CALORIMETRIC DETERMINATION OF THE HALF LIFE OF Cm^{242}. W.P.Hutchinson and A.G.White.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1365, 7 pp. (1954).

Calorimetric measurements on a 2 μg sample of Cm^{242} have confirmed the value of 162.5 days previously published for the half-life of this nuclide. A.

539.163.1

1541. A MEASUREMENT OF THE HALF-LIFE OF RaE (Bi^{210}).
J. Robert and J.Tobailem.
J. Phys. Radium, Vol. 17, No. 5, 440-1 (May, 1956). In French.

The decay of RaE was followed over 40 hours using an ionization chamber which formed one element of a balanced pair. A value of 5.013 ± 0.005 days for the half-life was obtained. M.A.Grace

539.163.1

1542. FAST COINCIDENCES WITH NaI(Tl) SCINTILLATORS. MEASUREMENT OF SHORT LIFETIMES OF EXCITED STATES IN Cs^{131} AND UX_2. H.Vartapetian, L.Dick, R.Foucher and N.Perrin.
J. Phys. Radium, Vol. 17, No. 7, 537-8 (July, 1956). In French.

Using E.M.I. 6262 phototubes and NaI(Tl) crystals, it is possible to measure, with a slow–fast coincidence apparatus, periods down to 10^{-9} sec. Application to the 122 keV excited state of Cs^{131} $T_{1/2} = (4 \pm 0.3) \times 10^{-9}$ sec and the 93 keV excited state of $UX_2(Pa^{234})$ $T_{1/2} = (1.8 \pm 0.3) \times 10^{-9}$ sec. A.

539.163.1

1543. SECOND EXCITED STATE OF F^{19}. HALF-LIFE AND MAGNETIC MOMENT. P.Lehmann, A.Lévêque, M.Fiehrer and R.Pick.
J. Phys. Radium, Vol. 17, No. 7, 560 (July, 1956). In French.

The variation of the angular distribution of the 197 keV gamma-ray of F^{19*} with respect to the direction of the proton beam is measured as a function of a magnetic field acting on the nuclei. The target of F^{19} is in a liquid state (KF in H_2O) to decrease the quadrupole interaction. The value found for μ(197 keV) is $+3.7 \pm 0.4$. No significant quadrupole perturbation is found. A.

539.163.1

1544. INDIRECT DETERMINATION OF THE HALF-LIFE OF RUBIDIUM. K.Fritze and F.Strassman.
Z. Naturforsch., Vol. 11a, No. 4, 277-80 (April, 1956). In German.

This was obtained from measurements of the Rb and Sr content of 2 lepidolite specimens of different origins; their ages were obtained from K-A measurements. The half-life was 4.6×10^{10} (±10%) years. A.O.Stanesby

539.163.2 : 539.166.83

1545. THE ELECTRON CAPTURE DECAY OF ^{228}Pa.
Ong Ping Hok and E.Arbman.
Ark. Fys., Vol. 11, Paper 9, 193-200 (1956).

The radiations of Pa^{228} were investigated with a double-focusing beta-ray spectrometer and with a scintillation counter. 43 conversion lines were detected, which could be ascribed to 18 gamma-transitions. The energies of most of these transitions agree fairly well with those found in the decay of $MsTh_2$. Multipolarities were assigned to the different transitions. A decay scheme is suggested based on the γ-γ coincidence measurements of Box and Klaiber, comprising a rotational level systems at 57.48 and 186.1 keV and perhaps also at 1070 and 1125 keV. A.

539.163.2

1546. ON THE DESCENDENTS OF ACTINIUM K: $_{87}Fr^{223}$.
M.Perey and J.P.Adloff.
J. Phys. Radium, Vol. 17, No. 7, 545-7 (July, 1956). In French.

Five methods are used to give the proof of the closing of the branching to AcX. The first determination of the energy of the α-rays emitted by Fr^{223} was made, the value being 5.34 ± 0.08 MeV. The value of the branching ratio is 6×10^{-5}. A.

539.163.2

1547. DECAY OF A^{35}. O.C.Kistner, A.Schwarzschild and B.M.Rustad.
Phys. Rev., Vol. 104, No. 1, 154-8 (Oct. 1, 1956).

The positron decay of A^{35} has been investigated with a magnetic lens beta-ray spectrometer and a NaI(Tl) scintillation spectrometer. A maximum beta-ray energy of 4.96 ± 0.04 MeV was found, which is 0.5 MeV higher than the previous values determined by cloud-chamber measurements. The new value is in good agreement with the end point predicted from Coulomb energy considerations. Two weak gamma-rays were found with energies of 1.19 ± 0.04 and 1.73 ± 0.04 MeV; both are in good agreement with reported levels in Cl^{35}.

Analysis of the complex beta-spectrum shows that approximately 7% of the A^{35} decays to two excited states in Cl^{35}. The ft value of the ground-state, mirror transition is 6200 ± 400 sec. From this ft value and the ft value of O^{14}, the $|\int\sigma|^2$ for this transition was estimated to be less than 0.13; the e-ν angular correlation coefficients were calculated to be +0.96 ± 0.04 and −0.93 ± 0.09 for the V,T and S,T beta interactions, respectively. These coefficients are indistinguishable from those expected in the case of a pure Fermi transition, indicating that A^{35} would be very suitable for identifying the Fermi invariant in the beta-decay interaction by an angular correlation experiment. A.

539.163.2

1548. DECAY SCHEME OF Re^{183} AND ROTATIONAL BANDS OF DAUGHTER NUCLEUS W^{183}. S.Thulin, J.O.Rasmussen, C.J.Gallagher,Jr, W.G.Smith and J.M.Hollander.
Phys. Rev., Vol. 104, No. 2, 471-4 (Oct. 15, 1956).

The electron-capture decay of 70 day Re^{183} has been studied, principally by conversion electron spectroscopy at 0.1% resolution. All but one of the eighteen gamma-transitions identified in the present study have been seen by others from beta-decay of Ta^{183} to the same daughter nucleus W^{183}. The transition intensities of the present study suggest an assignment of 5/2 + to Re^{183}. New information on M1—E2 mixing ratios for some of the gamma-transitions is obtained. A.

539.163.2

1549. THE DECAY OF RaC". T.Mayer-Kuckuk.
Z. Naturforsch., Vol. 11a, No. 8, 627-30 (Aug., 1956). In German.

γ-γ and β-γ coincidence spectrometers were used with oscillographic recording to yield results which can be represented as points with coordinates proportional to the energies of the coincident radiations. The disintegration is essentially a β-spectrum of E_{max} = 1.96 ± 0.1 MeV, followed by a triple γ-cascade of 2.36—0.3—0.78 MeV; the disintegration energy is 5.4 ± 0.12 MeV. A.O.Stanesby

539.163.2

1550. DETERMINATION OF THE BRANCHING RATIO IN THE DISINTEGRATION SCHEME OF Po^{210}. N.S.Shimanskaya.
Zh. éksper. teor. Fiz., Vol. 31, No. 2(8), 174-7 (1956). In Russian.

The magnitude of the branching ratio in the disintegration scheme of Po^{210} was determined. The value $(1.2 \pm 0.2) \times 10^{-5}$ was obtained for the transition to the excited level of Pb^{206} (with an energy of E ≅ 800 keV). A.

539.164 : 778.34

1551. LONG-RANGE PARTICLES EMITTED BY NATURAL α RADIOELEMENTS. M.Ader.
J. Phys. Radium, Vol. 17, No. 7, 541-4 (July, 1956). In French.

Particles with an unusually long range are emitted by the polonium and plutonium 239 sources, as well as by the thorium and actinium active deposits. The maximum range appears to be approximately the same for all the elements studied and would be greater than 300 μ within the photographic emulsion. A.

539.164 : 539.166

1552. $\alpha-\gamma$ SPECTROMETRY. SOME MEASUREMENTS ON Pa^{231}, RAc. R.Foucher, L.Dick, N.Perrin and H.Vartapetian.
J. Phys. Radium, Vol. 17, No. 7, 581-2 (July, 1956). In French.

Verification by $\alpha-\gamma$ coincidence of the period of the 27 keV transition in $Pa^{231} \rightarrow Ac^{227}$. The close study of the delayed coincidence curve makes it possible to place this period on the 27 keV level (E_1 transition). The same study applied to the 50 keV γ gives an upper limit of 2×10^{-9} sec for the period of this E_1 transition. A.

539.164 : 539.166

1553. ALPHA-PARTICLE AND GAMMA-RAY SPECTRA OF THE U^{230} DECAY SERIES. F.Asaro and I.Perlman.
Phys. Rev., Vol. 104, No. 1, 91-9 (Oct. 1, 1956).

The radiations of the U^{230} family have been investigated with an electromagnetic alpha-particle spectrograph and gamma-ray scintillation counters. The following alpha groups were found: U^{230}—5.884 (67.2%), 5.813 (32.1%), 5.658 (0.7%); Th^{226}—6.330 (79%), 6.220 (19%), 6.095 (1.7%), 6.029 (0.6%); Ra^{222}—6.551; Em^{218}—7.127 MeV. The following gamma-rays were seen: U^{230}—72 (0.75%), 158 (0.33%); 232 (0.24%); Th^{226}—112 (4.8%); 131 (0.4%), 197 (0.40%), 242 (1.2%); Em^{218}—609 keV (2.0%). The results are correlated into decay schemes, which are discussed with respect to current systematics and theory of complex alpha spectra and excited states of even-even nuclei. A.

539.164.2

1554. A VERIFICATION OF THE PROBABILITY LAWS FOR RANDOM AND TIME-CORRELATED ALPHA EMISSION. H.Lindeman.
Bull. Res. Coun. Israel, Vol. 5A, No. 2-3, 135-42 (Jan.-April, 1956).

Measurements on the probability functions for the alpha emission of polonium, the radium series and the thorium series were carried out with a methane flow proportional counter. Disintegrations of polonium and the radium series occurred in good agreement with the Bateman—Poisson law for random emission; those of the thorium series appeared to obey a more complicated probability function, which can be found theoretically as a generalization of the Bateman—Poisson law for cases of time-correlated emission. A.

539.164.75

1555. ABSORPTION OF α-PARTICLES IN MATTER BY MAGNETIC DEVIATION. J.Blandin-Vial.
J. Phys. Radium, Vol. 17, No. 7, 568-70 (July, 1956). In French.

Contribution to the study of the "retardation" of α-particles through thin metallic films. A.

539.164.75

1556. THE RELATIVE STOPPING POWER OF SEVERAL GASES FOR Po-α PARTICLES. B.Yaramis.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 21, No. 2, 81-4 (April, 1956).

In this investigation the relative stopping power of ethane (C_2H_6) propane (C_3H_8), butane (C_4H_{10}), ethylene (C_2H_4), propylene (C_3H_6) and acetylene (C_2H_2) was determined. A mica end-window G.M. counter, and an appropriate counter circuit were made for this purpose. A.

539.165

1557. CONSTRUCTION OF A SPECTROMETER FOR NEUTRINO RECOILS: INVESTIGATION OF THE DECAY OF A^{37}. O.Kofoed-Hansen and A.Nielsen.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 29, Paper 15, 60 pp. (1955).

The motion of the recoils has been studied in crossed electric and magnetic fields. The particles have been detected by the charge they give off to the collector system. The theory of the instrument is described, details of its construction are given and, finally, results obtained in an investigation of A^{37} are presented. A.

539.165

1558. ELECTRON SPECTRUM OF THE U^{230} DECAY SERIES. W.G.Smith, F.Asaro and J.M.Hollander.
Phys. Rev., Vol. 104, No. 1, 99-100 (Oct. 1, 1956).

The energies of the first excited states of Th^{226}, Ra^{222} and Em^{218} have been measured as 72.13 ± 0.06, 111.1 ± 0.3 and 324.6 keV with photographic-recording beta-ray spectrographs. The energy of the second excited state in Th^{226} has been measured as 226.4 keV, and a comparison is made with predictions of the Bohr—Mottelson nuclear model. A.

539.165 : 539.166

1559. RADIATIVE ELECTRON CAPTURE IN CESIUM-131. D.D.Hoppes and R.W.Hayward.
Phys. Rev., Vol. 104, No. 2, 368-9 (Oct. 15, 1956).

The continuous electromagnetic radiation accompanying orbital electron capture in Cs has been investigated with a scintillation spectrometer. The intensity distribution as a function of energy may be accounted for by the theoretical predictions of Glauber and Martin. The end-point energy of the 1S electron capture contribution to the continuous spectrum is 320 ± 10 keV. A.

539.165.08

1560. THE DOSIMETRY OF BETA SOURCES IN TISSUE. THE POINT-SOURCE FUNCTION. R.Loevinger.
Radiology, Vol. 66, No. 1, 55-62 (Jan., 1956).

See also Abstr. 5925 (1954) and 5611 (1955). A two-parameter function has been derived empirically to represent the experimental data for the energy distribution in air around point sources of beta-ray emitters. All information at present available is presented graphically for twelve common radioisotopes. The same function,

with different values for the parameters, represents the available data for solids and it is suggested that for dosimetry purposes, it will represent the corresponding distribution in soft tissue.

J.R.Mallard

539.165.2

1561. β DISINTEGRATIONS IN THE NEIGHBOURHOOD OF THE MAGIC NUMBER 14. M.E.Nahmias and T.Yuasa.
J. Phys. Radium, Vol. 17, No. 7, 536 (July, 1956). In French.

The anomalous behaviour of neutrons and protons in the filling up of the shells for the magic number 14 is confirmed. A.

539.166

1562. INFLUENCE OF K CAPTURE ON ANGULAR CORRELATIONS. P.Lehmann and J.Miller.
J. Phys. Radium, Vol. 17, No. 7, 526-7 (July, 1956). In French.

The differential anisotropy of the angular correlation of the cascade 170 keV-250 keV from In^{111} has been measured using ionic and metallic polycrystalline sources. With a metallic source, the variation A(t) expected from a static electric quadrupole interaction is found. In the ionic sources, fluctuating fields resulting from the K capture are present. A.

539.166

1563. STUDY OF SOME GAMMA SPECTRA OF EXCITED LEVELS OF LIGHT NUCLEI. S.Gorodetzky, T.Muller and M.Port.
J. Phys. Radium, Vol. 17, No. 7, 549-50 (July, 1956). In French.

The gamma-ray transitions of Ne^{21*} were determined by a proton–gamma coincidence method, with the reaction $Ne^{20}(d,p)Ne^{21}$. The gamma-rays found were: 0.35 MeV; 1.05 MeV; 1.42 MeV and 2.78 MeV. A.

539.166

1564. STUDY OF THE DOPPLER EFFECT OF GAMMA RAYS FROM THE REACTION $B^{10}(\alpha,p)C^{13}$. R.J.Mackin, W.R.Mills and J.Thirion.
J. Phys. Radium, Vol. 17, No. 7, 551-2 (July, 1956). In French.

The Doppler shift of the gamma-rays (3.64 and 3.84 MeV) from the reaction $B^{10}(\alpha,p)C^{13}$ has been studied. The gamma-ray of 3.64 MeV is the only one to exhibit a Doppler shift. These results indicate lifetimes shorter or longer than 3×10^{-13} sec. A.

539.166

1565. ON THE TRANSITION $O^+ \rightarrow O^+$ IN Zr^{90}. T.Yuasa, J.Laberrigue-Frolow and L.Feuvrais.
J. Phys. Radium, Vol. 17, No. 7, 558-9 (July, 1956). In French.

An experimental research on internal conversion electrons and a study of γ-rays emitted in the disintegration of Y^{90}. The observation of 2 lines of internal conversion electrons corresponding to the de-excitation from the 1.74 MeV level [$e_C/\beta^- = (1.6 \pm 0.6) \times 10^{-4}$] and the absence of the γ line corresponding to this de-excitation ($\gamma/\beta^- < 4.3 \times 10^{-6}$) allow the existence of a $O^+ \rightarrow O^+$ transition in Zr^{90} to be confirmed. A.

539.166 : 539.172.13

1566. γ-RESONANCES IN REACTIONS OF PROTON CAPTURE BY SILICON. S.P.Tsÿtko and Yu.P.Antuf'ev.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1171 (1956). In Russian.

The excitation function of Si(p,γ)P is studied in the energy interval 500-2600 keV. A large number of resonances were found. G.E.Brown

539.166.08

1567. REDUCED COMPTON EFFECT SCINTILLATION SPECTROMETER. K.I.Roulston and S.I.H.Naqvi.
Rev. sci. Instrum., Vol. 27, No. 10, 830-2 (Oct., 1956).

To assess the effectiveness of plastic phosphors in the reduction of Compton effect in scintillation spectrometers, a spectrometer with a small NaI(Tl) crystal surrounded by a large plastic phosphor has been constructed. The output from the plastic phosphor is put in anticoincidence with the output from the NaI(Tl) crystal. A reduction of Compton contribution in the scintillation spectrum to about 35% of original value is obtained. Comparison of results with, and without, the shield enables certain spectral features to be identified. Possible applications are discussed. Transistor anticoincidence circuits are used. A.

539.166.08 : 537.542

1568. SCINTILLATION SPECTROMETER FOR GAMMA RAYS. M.Ageno, G.Cortellessa and R.Querzoli.
R.C. Ist. Super. Sanità, Vol. 18, Pt 5, 344-66 (1955). In Italian.

A description is given of a single-crystal scintillation spectrometer for gamma-rays especially adjusted for precision measurements with negligible long-time drift. The criteria and methods adopted for the determination of the counting threshold and of deviations from linearity are set out, and also for checking the stability and the energy calibration. A.

539.166.08

1569. SCINTILLATION SPECTROMETER FOR COINCIDENT EVENTS. M.Ageno, G.Cortellessa and R.Querzoli.
R.C. Ist. Super. Sanità, Vol. 18, Pt 5, 367-75 (1955). In Italian.

A description is given of a spectrometer containing two crystals in coincidence. Each branch is equipped with a differential amplitude discriminator. The apparatus is designed to operate in the widest possible variety of experimental conditions and to give precision measurements with negligible long-time drift. A.

539.166.08 : 537.531.08 : 77.023

STABILIZATION FILM PROCESSING FOR X- AND γ-RAY DOSIMETRY. See Abstr. 991

539.166.2 : 539.18

1570. ENERGY SPECTRUM OF γ-RAYS FROM THE DECAY OF π^0-MESONS. A.A.Tyapkin.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1150-4 (1956). In Russian.

Assuming that the π^0-mesons have an angular distribution $a + b\cos^2\theta$, the emitted γ-rays will have a distribution $A + B\cos^2\theta$. Expressions for A and B are given. G.E.Brown

539.166.74

1571. CONTRIBUTION OF THE ELECTRIC FIELD OF THE NUCLEI TO THE ELASTIC SCATTERING OF γ OF 1.33 MeV AND 2.62 MeV. P.Eberhard, L.Goldzahl, E.Hara and J.Mey.
J. Phys. Radium, Vol. 17, No. 7, 573-5 (July, 1956). In French.

If it is assumed that the calculations of Rayleigh scattering by the atom's bound electrons are even very approximately correct, the measurements bring evidence of this contributon. A.

539.166.83

1572. MULTIPOLE ORDER OF THE γ-RAYS FROM $_{81}Tl^{208}$. O.B.Nielsen.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 30, Paper 11, 15 pp. (1955).

The internal conversion lines originating in excited levels of $_{81}Tl^{208}$ have been obtained in coincidence with α-particles from $_{83}Bi^{212}$. Five of the transitions were found to be magnetic dipole from their internal conversion coefficients. In three cases, the multipole order was confirmed by the K/L ratios. The results are compared with the model of Pryce. A.

539.166.83

1573. MEASUREMENT OF CONVERSION COEFFICIENTS BY THE METHOD OF GAMMA–GAMMA COINCIDENCES. APPLICATIONS. N.Perrin, L.Dick, R.Foucher and H.Vartapetian.
J. Phys. Radium, Vol. 17, No. 7, 539-40 (July, 1956). In French.

Correction factor to be applied to the measurement of conversion coefficients by the coincidence method when the resolution of the circuit is short. Application to the 195 keV and 125 keV γ-rays of Rh^{102}. A.

539.166.83

1574. EXPERIMENTAL STUDY OF INTERNAL CONVERSION PAIRS. S.Gorodetzky, R.Armbruster and P.Chevallier.
J. Phys. Radium, Vol. 17, No. 7, 548 (July, 1956). In French.

A beta-ray spectrometer for the angular-correlation study of internal conversion pairs has been designed. It has been used to determine the multipolarity of gamma-rays in the reactions $C^{12}(d,p)C^{13}$, $Be^9(\alpha,n)C^{12}$ and $B^{11}(p,\gamma)C^{12}$. A.

539.166.83

1575. INTERNAL CONVERSION COEFFICIENTS OF γ-RADIATION IN THE K-SHELL. L.A.Sliv and I.M.Band.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 134-6 (1956). In Russian.

Calculations of the coefficients for the first five electric and magnetic multipoles are described for 16 elements (Z = 25 to Z =98) and for 13 values of transition energy. The calculations take into account the effect of screening and the finite radius of the nucleus. A table is presented of the internal conversion coefficients for uranium (Z = 92) and these are shown to be lower than the coefficients given by M.E.Rose (Beta and Gamma-Ray Spectroscopy, K.Siegbahn). Z.Krasucki

539.166.83 : 537.533.35

RESEARCH ON LOW-ENERGY ELECTRONS EMITTED BY RADIOACTIVE SUBSTANCES. See Abstr. 1368

539.166.835

1576. FORMATION OF POSITRONIUM IN SOLIDS. S.D.Warshaw.
Phys. Rev., Vol. 104, No. 1, 21-2 (Oct. 1, 1956).

It is pointed out that several results of experiments on positron annihilation in solids are quantitatively consistent with the assumption of positronium formation and subsequent conversion between the singlet and triplet states. A.

539.166.835

1577. ON THE PAIR PRODUCTION CROSS-SECTION FOR 2.62 MeV RADIATION. S.Barkan.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 21, No. 1, 50-63 (Jan., 1956).

Continuation of paper reported in Abstr. 10477 (1954). It is concluded that the numerical results obtained from the experiment for the absolute values of the Φ_{pair} in Al, Cu, Cd and Pb seem to follow very well the Jaeger–Hulme's exact calculation, and that this may partly account for the apparently high value of the total linear absorption coefficient in lead. A comparison of the results with theoretical and experimental values confirming the validity of Born approximation is also made, with some additional discussion and criticism on the total absorption coefficient. A.

539.166.835

1578. PROBABILITY OF ANNIHILATION OF PARAPOSITRONIUM WITH CALCULATION OF RADIATIVE CORRECTIONS. A.I.Alekseev.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 164-6 (1956). In Russian.

Since the three-photon decay is forbidden, this calculation includes all effects of the order of $e^2/\hbar c$ of the main term. The relative correction is 0.25 $e^2/\hbar c$. G.E.Brown

NUCLEAR REACTIONS 539.17

539.172

1579. THE STATISTICAL THEORY OF NUCLEAR REACTIONS. C.Bloch.
J. Phys. Radium, Vol. 17, No. 7, 510-15 (July, 1956). In French.

A very elementary account of the general principles of the statistical theory of nuclear reactions in the intermediate energy range is presented. It seems possible to define a model allowing predictions of averaged cross-sections not only for elastic scattering of neutrons, but also for nuclear and photonuclear reactions. A.

539.172

1580. TOWARDS A STATISTICAL THEORY OF FISSION WIDTH. V.G.Nosov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 880-1 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 746-7 (July, 1956).

An estimate of the fission width Γ is made for the energy region in which classical statistics do not apply by calculating the probability density that the dividing degree of freedom exceeds the fission threshold E_f. This probability is obtained by applying a microcanonical distribution to the nucleus. G.E.Brown

539.172

1581. THE YIELDS OF ^{129}I IN NATURAL AND IN NEUTRON-INDUCED FISSION OF URANIUM. B.C.Purkayastha and G.R.Martin.
Canad. J. Chem., Vol. 34, No. 3, 293-300 (March, 1956).

Measurements have been made, by a radioactivation technique, of the I^{129} formed in uranium by pile-neutron-induced fission, and in pitchblende by the natural fission of uranium. The amount found in the pile-neutron-irradiated uranium corresponds to a fission yield of 0.90% at mass 129. The natural production of I^{129} in pitchblende is discussed in the light of the mass-spectrometric measurements of spontaneous fission xenon made by Thode and his collaborators. An upper limit of 1 part in 10^8 can be set for the occurrence of I^{129} in natural iodine. The pile neutron capture cross-section of I^{129} has been measured as 35 barns. A.

539.172 : 539.172.13

1582. ON THE IDENTIFICATION OF STOPPING PARTICLES IN NUCLEAR EMULSIONS. S.Nilsson.
Ark. Fys., Vol. 11, Paper 10, 201-16 (1956).

Measurements of constant sagitta, mean gap length v. residual range and photometric density v. residual range, have been carried out on 24 stopping protons and 10 π-mesons in G5 emulsion. The Fay–Gottstein–Hain p = 0.5 μ (protons) and π = 0.5 μ (π-mesons) scattering scheme is calibrated and the conversion factors deduced when calculating the second differences from the third and fourth differences respectively. The photometric density is normalized to minimum tracks and the absolute normalized photometric coefficient and gap coefficient are compared. A linear approximation to the points of photometric density v. residual range in a log-log plot is shown to give reasonable values for sufficiently large ranges. An apparatus for measuring photometrically ionization of tracks in nuclear emulsions is briefly described. A.

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.172 : 539.18

1583. DISINTEGRATION OF BERYLLIUM AND CARBON NUCLEI AS A RESULT OF π^--MESON CAPTURE. A.A.Varfolomeev and R.I.Gerasimova.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1166-7 (1956). In Russian.

Crystals of beryllium and carbon are spread on the emulsions, and irradiated by slow π^--mesons. Seven cases of absorption in carbon and twelve in beryllium are found. A study of the stars seems to indicate that a large part of the rest energy of the π^--meson is transmitted to one or two neutrons. G.E.Brown

539.172

1584. ELASTIC AND INELASTIC SCATTERING OF 187-MeV ELECTRONS FROM CARBON-12. J.H.Fregeau.
Phys. Rev., Vol. 104, No. 1, 225-35 (Oct. 1, 1956).

The scattering of 187 MeV electrons from C^{12}, reported previously, has been extended to 138°. It has been possible to separate the elastic scattering from the inelastic scattering and to resolve the inelastic groups from the 4.43, 7.65 and 9.61 MeV nuclear levels. "Absolute" values were obtained by comparing the scattering from carbon with the scattering from hydrogen and computing the proton cross-section. The angular distribution of the elastically-scattered electrons falls off more steeply than the angular distribution of the inelastically-scattered electrons. Analysis of the data, using the Born approximation, shows that the root-mean-square radius of C^{12} (corrected for breakdown of the Born approximation) is $(2.37 \pm 0.05) \times 10^{-13}$ cm with a surface thickness of $(2.0 \pm 0.4) \times 10^{-13}$ cm. The corresponding value of r_0, the "classical" radius parameter, is $(1.33 \pm 0.02) \times 10^{-13}$ cm which is larger than that found from electron-scattering measurements for the heavy nuclei and is in agreement with the trend for light nuclei. The scattering from the 4.43 MeV and 7.65 MeV levels is larger than that predicted by some shell-model calculations. The transition from the ground state to the 9.61 MeV level appears to be either quadrupole or electric monopole, which gives a spin and parity assignment of either 2^+ or 0^+. A.

539.172.1

1585. STUDY OF THE TRANSMUTATION OF COPPER BY NITROGEN, OXYGEN AND NEON. H.Faraggi, J.Olkowsky, J.Beydon, M.Crut, R.Chaminade and A.Papineau.
J. Phys. Radium, Vol. 17, No. 7, 519-20 (July, 1956). In French.

The relative yields of the radioelements formed were studied. The most probable mechanism of these reactions is the formation of a compound nucleus resulting from the addition of the two nuclei and followed by the evaporation of a few

nucleons. Nevertheless, the quantitative comparison of experimental yields with the prediction of the evaporation theory shows certain discrepancies. A.

539.172.1

1586. EXCITATION FUNCTIONS FOR TWO NITROGEN-SODIUM NUCLEAR REACTIONS. M.L.Halbert, T.H.Handley and A.Zucker
Phys. Rev., Vol. 104, No. 1, 115-17 (Oct. 1, 1956).

Excitation functions were measured for two nitrogen-induced nuclear reactions on sodium, $Na^{23}(N^{14},\alpha p)P^{32}$ and $Na^{23}(N^{14},\alpha 2p)Si^{31}$. The total cross-section at 26 MeV for the first reaction is 91 ± 18 millibarns and for the second reaction 4.1 ± 0.8 millibarns. A calculation based on the statistical model of the nucleus gives a value of about 50 for the ratio of $\sigma_{P^{32}}/\sigma_{Si^{31}}$, which may be compared with the experimental ratio of 22 ± 5. A.

539.172.11

1587. ELASTIC AND INELASTIC SCATTERING OF 31.5-MeV ALPHA PARTICLES BY LIGHT NUCLEI. H.J.Watters.
Phys. Rev., Vol. 103, No. 6, 1763-72 (Sept. 15, 1956).

Using the 31.5 MeV alpha-particle beam of the Massachusetts Institute of Technology cyclotron, a study has been made of the angular distributions obtained in the (α,α) and (α,α') interactions on Li^6, C^{12} and Mg^{24}. Separation of the alpha particles from other products of the alpha-induced reactions was accomplished by a dE/dx and E two-crystal technique developed at the cyclotron laboratory. The experimental inelastic angular distributions are shown to be in agreement with those predicted by the direct surface interaction theory. The experimental elastic angular distributions are compared with the diffraction of light by an opaque sphere. The probabilities of excitation of isotopic spin "forbidden" and "allowed" levels were also obtained for specified levels of Li^6 and N^{14}. A.

539.172.13

1588. FISSION OF URANIUM NUCLEI BY FAST PROTONS. V.I.Ostroumov.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 3, 409-11 (1955). In Russian. English translation in: Atomic Energy Res. Establ. (Harwell) Transl. No. 692 (1956).

The angular distribution of fission fragments, from uranium bombarded by 650 MeV protons, has been examined using nuclear emulsions impregnated with uranium. From this the momentum handed over to the fissioning nuclei corresponds to a mean excitation of about 140 MeV. Analysis of 1853 cases showed that the ratio of probability of emission of a fragment between 0^0 and 45^0 to the initial direction to the emission between 45^0 and 90^0 was 0.64 ± 0.06. J.H.Fremlin

539.172.13

1589. STUDY OF HIGH-ENERGY INTERACTIONS PRODUCED IN PHOTOGRAPHIC EMULSION. II. J.Combe.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 2, 182-234 (1956). In French.

Experimental results for 340 MeV incident protons, reported in Pt I (Abstr. 9078/1955), are interpreted with the aid of Monte Carlo calculations of proton–nuclear interactions. Secondary particles of energy > 100 MeV only are considered. For heavy target nuclei (Ag, Br), the experimental observations (spectra, angular distributions and nature of the secondary particles) are consistent with cascades of nucleon–nucleon collisions in the target nuclei. For light nuclei (C, N, O), the occurence of a significant proportion of $p-\alpha$, $p-H^3$, etc., interactions, due to "instantaneous sub-structures" in the target nuclei is indicated. Possible future lines of experimental investigation in this field are discussed. J.J.Wilkins

539.172.13

1590. Q VALUE FOR THE $Cu^{65}(p,n)Zn^{65}$ REACTION. J.B.Marion and R.W.Kavanagh.
Phys. Rev., Vol. 104, No. 1, 107 (Oct. 1, 1956).

The threshold for neutron emission from the $Cu^{65}(p,n)Zn^{65}$ reaction has been measured to be 2.1653 ± 0.0015 MeV, relative to the $Li^7(p,n)Be^7$ threshold at 1.8811 MeV. The Q-value, -2.1322 ± 0.0015 MeV, is in close agreement with previous threshold measurements and with the results of the Zn^{65} β-decay and neutron scattering measurements. This indicates that compound nucleus resonances probably do not affect the determination of the Q-value for this reaction from the neutron threshold. A.

539.172.13

1591. PICKUP BEHAVIOR IN $Li^6(p,He^3)He^4$ AND $F^{19}(p,\alpha)O^{16}$ AT 18 MeV. J.G.Likely and F.P.Brady.
Phys. Rev., Vol. 104, No. 1, 118-23 (Oct. 1, 1956).

Differential cross-sections were measured for $F^{19}(p,\alpha)O^{16}$, to the ground state, and for $Li^6(p,He^3)He^4$. The angular distribution from $F^{19}(p,\alpha)O^{16}$ shows three maxima, which can be fitted approximately by the Born approximation for triton pickup. Empirical adjustment of phase, in the theoretical distribution, gives a better fit with a smaller nuclear radius. The cross-section at 18.5 MeV is 1.5 times larger than at 16 MeV. The angular distribution of He^3 particles from $Li^6(p,He^3)He^4$ shows a maximum at zero degrees, explained qualitatively by deuteron pickup. Cross-sections, at 18.5 and 15 MeV, are 1.1 and 1.7 times smaller, respectively, than expected, through pickup theory, from published 14 MeV data on $Li^6(n,t)He^4$. Maxima observed at 110 and 180^0 are examined in terms of direct interaction between the proton and alpha particle in Li^6; results are inconclusive, due to inadequacies of current theory. The pickup cross-sections give reasonable values of triton and deuteron reduced widths in F^{19} and Li^6, respectively. A.

539.172.13

1592. YIELDS OF THE $O^{18}(p,\alpha)N^{15}$ AND $O^{18}(p,n)F^{18}$ REACTIONS FOR PROTONS OF 800 keV TO 3500 keV. H.A.Hill and J.M.Blair.
Phys. Rev., Vol. 104, No. 1, 198-201 (Oct. 1, 1956).

The yield of the $O^{18}(p,\alpha)N^{15}$ reaction was observed at 90^0 with respect to the ion beam for protons from 800 keV to 3500 keV. Resonances in the yield located fifteen energy levels in F^{19} not previously observed. Neutrons from the $O^{18}(p,n)F^{18}$ reaction were observed in the forward direction above the threshold ($E_p = 2577 \pm 8$ keV). Simultaneous observation of alpha-particles and neutrons showed that the resonance energies for the two reactions agree in some cases but not in others. A.

539.172.13

1593. ELASTIC SCATTERING OF PROTONS FROM Na^{23}. N.P.Baumann, F.W.Prosser, Jr, W.G.Read and R.W.Krone.
Phys. Rev., Vol. 104, No. 2, 376-82 (Oct. 15, 1956).

The elastic scattering of protons from Na^{23} has been obtained over the proton energy range from 0.58 to 1.50 MeV at the angles of 90^0 and 157.5^0. Additional readings were made at angles of 125^0 and 140^0 at resonances. Thin metallic sodium targets on thin nylon backings were used. Out of 31 known resonances for Mg^{24} in this energy region, 12 unambiguous assignments of spin and parity were made. With the energy given in MeV, these are $E_p = 0.594$ (3–); 0.725 (0–); 0.797 (1–); 0.815 (2+); 0.849 (4+); 0.877 (1+); 0.922 (2+); 1.022 (2–); 1.176 (1+); 1.258 (1+); 1.288 (1–); 1.398 (3+); and 1.460 (3–). Three tentative assignments were made for $E_p = 1.206$ (2–); 1.213 (3+); and 1.365 (0–). The excitation curve for alpha-particle emission to the ground state of Ne^{20} was obtained simultaneously to give a differential cross-section for this reaction. Resonance states were found which agreed in spin and parity as well as energy with those found before only in the elastic scattering of alpha-particles from Ne^{20}. A.

539.172.13

1594. POLARIZATION OF 220-MeV PROTONS ELASTICALLY SCATTERED FROM CARBON. W.G.Chesnut, E.M.Hafner and A.Roberts.
Phys. Rev., Vol. 104, No. 2, 449-56 (Oct. 15, 1956).

Protons polarized to 89% have been scattered from C^{12} in the laboratory angular range from 4 to 40 degrees. Data were obtained on angular distributions and asymmetries in three closely spaced energy channels spanning the high-energy tail of the incident spectrum. In spite of the great width of this spectrum, it was possible to extrapolate the data so as to give fair separation of elastic from inelastic scattering. The elastic asymmetries exhibit clear evidence of a deep minimum at 27 degrees followed by a strong maximum at 35 degrees, in qualitative agreement with various predictions from L.S coupling in an optical model of the scattering. Possible reasons are given for the failure of the minimum to appear in the results of other experimenters. A.

539.172.13

1595. THE SCATTERING OF 9.6 MeV PROTONS BY Mg. G.W.Greenlees and A.E.Souch.
Proc. Phys. Soc. A, Vol. 69, Pt 9, 686-90 (Sept., 1956).

Absolute differential cross-sections are given for the elastic and inelastic scattering of 9.62 MeV protons by Mg for an angular range of 25^0–145^0 (laboratory coordinates). For scattering by the 1.37 MeV level of Mg^{24}, the angular distribution is also given for an incident energy of 8.86 MeV. A marked difference in angular distribution at the two energies is noted. A.

539.172.13

1596. THE REACTION $^{24}Mg(p,\gamma)^{25}Al$. J.Varma.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 641-5 (Aug., 1956).

Gamma-rays from the $Mg^{24}(p,\gamma)Al^{25}$ reaction, produced by emitting the 220 keV resonance, have been investigated using a γ-ray crystal spectrometer and pulse height analyser. Gamma-rays of energy 2.51, 2.06, 1.57, 0.94 and 0.453 MeV were observed, corresponding to excited levels in Al^{25} at 0.453, 0.94, 1.81 and 2.51 MeV. Angular distribution and relative intensity measurements indicate spin and parity assignment of $\frac{1}{2}$+ to the 0.453 level, 3/2+ to the 0.94 level and $\frac{1}{2}$+ to the 2.51 MeV level. D.R.Chick

539.172.13

1597. THE NUCLEAR REACTION $Be^9(p,d)Be^8$. T.I.Kopaleïshvili.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1145-6 (1956). In Russian.

The interaction is assumed to be only between the last neutron of Be^9 and the proton which picks it up. G.E.Brown

539.172.13 : 539.18

1598. PRODUCTION OF CHARGED MESONS IN BERYLLIUM AND CARBON BY 660 MeV PROTONS. M.G.Meshcheryakov, I.K.Vzorov, V.P.Zrelov, B.S.Neganov and A.F.Shabudin.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 55-62 (1956). In Russian.

The energy spectrum of positive and negative π-mesons emitted in p—Be and p—C collisions at an angle of 24° with respect to the 660 MeV proton beam has been measured by the magnetic analysis technique. A very pronounced peak has been observed in the π^+-spectrum at energy of 210 MeV in the laboratory system, whereas the number of π^--mesons only slightly varies in the range from 60 to 250 MeV. The probability of creation of π^+-mesons in collisions between the incident protons and protons bound in the Be or C nuclei is at least three times smaller than that for collisions between the incident protons and free protons. In the centre-of-mass system the meson peak is located approximately at 100 MeV. The ratio of the π^+- and π^--mesons yields for Be and C has been determined over the full range of the spectra. The ratio of the total yields of π^+- and π^--mesons from these elements were found to be respectively 5.3 ± 0.6 and 7.0 ± 0.8. A.

539.172.13 : 539.166

Si(p, γ)P REACTION. See Abstr. 1566

539.172.13 : 539.18

p—p REACTIONS WITH PRODUCTION OF π-MESONS. See Abstr. 1650

539.172.13

1599. STUDY OF THE He^3 REACTION WITH DEUTERONS. A.P.Klyucharev, B.N.Esel'son and A.K.Val'ter.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 737-9 (1956). In Russian.

The excitation curve of the reaction $He^3(d,p)He^4$ is measured at an angle of 90° for incident deuteron energies up to 1500 keV. G.E.Brown

539.172.13

1600. $B^{10}(d,\alpha)Be^{8*}$ REACTION. C.Bockelman and A.Lévêque.
J. Phys. Radium, Vol. 17, No. 7, 557 (July, 1956). In French.

The excited states of Be^8 in the excitation region between 0 and 9 MeV has been searched using the M.I.T. broad-range heavy-particle spectrograph. The reaction $B^{10}(d,\alpha)Be^8$ has been used, the bombarding energy being 5 MeV. No level has been found excepting the 2.94 well established state. A.

539.172.13

1601. STUDY OF THE REACTION $Li^6(d,n\gamma)Be^7$. G.C.Neilson and J.B.Warren.
Phys. Rev., Vol. 103, No. 6, 1758-63 (Sept. 15, 1956).

The angular correlation of the neutrons to the first excited state in Be^7 and the associated 430 keV gamma-rays has been measured. Energy selection of the neutrons was made possible by a time-of-flight spectrometer. The angular correlation were predominantly isotropic at bombarding energies below 600 keV, while above this energy the correlations showed a strong peaking in the beam direction. Analysis using stripping theory shows that the 430 keV state is very probably a $J = \frac{1}{2}$ — state. The excitation function corrected for Coulomb penetration shows a resonance corresponding to an excited state in Be^8 at 22.6 MeV. A.

539.172.13

1602. POLARIZATION OF PROTONS FROM DEUTERON STRIPPING IN CARBON. P.Hillman.
Phys. Rev., Vol. 104, No. 1, 176-8 (Oct. 1, 1956).

The polarization of protons from the stripping of 4 MeV deuterons in carbon at 30° has been measured by scattering in helium. The value of $P = -58\% \pm 13\%$ is larger than, but the sign is in agreement with, predictions based on a simple stripping-plus-potential scattering picture. A.

539.172.13

1603. (d,p) REACTIONS WITH Kr^{78} AND Kr^{80}. N.C.Blais and W.W.Watson.
Phys. Rev., Vol. 104, No. 1, 202-4 (Oct. 1, 1956).

Three targets of krypton gas, the first analysing Kr^{78} 45%, Kr^{80} 51%, Kr^{82} 3.8%, the second Kr^{78} 28%, Kr^{80} 65%, Kr^{82} 6.3%, and the third Kr^{78} 14.2%, Kr^{80} 69.8%, Kr^{82} 14.4%, were produced by the thermal diffusion separation process. The (d,p) reactions for these samples were studied with the 4 MeV deuteron beam of a cyclotron. The ground state and first excited state Q values of Kr^{79} are 5.98 ± 0.05 MeV and 5.52 ± 0.05 MeV, respectively. The ground state Q value of Kr^{81} is tentatively set at 5.63 ± 0.1 MeV. The masses of Kr^{79} and Kr^{81} are 78.945 30 ± 11 and 80.942 49 ± 14 a.m.u. A.

539.172.13

1604. APPROXIMATION FOR DEUTERON STRIPPING REACTIONS ON HEAVY TARGET NUCLEI. L.C.Biedenharn, K.Boyer and M.Goldstein.
Phys. Rev., Vol. 104, No. 2, 383-6 (Oct. 15, 1956).

The (d,p) stripping reaction for $l_n = 0$ is discussed for the case where Coulomb effects predominate employing a zero-range neutron—proton interaction and neglecting the finite nuclear size. The angular distribution of the emergent proton is shown to change drastically from forward to backward peaking as the Sommerfeld number η increases. The case $l_n \neq 0$ is discussed. A.

539.172.13

1605. $N^{15}(d,p)N^{16}$ REACTION AND THE LOW EXCITED STATES OF N^{16}. W.Zimmermann,Jr.
Phys. Rev., Vol. 104, No. 2, 387-9 (Oct. 15, 1956).

The angular distributions of proton groups to the first three excited states of N^{16}, produced in the reaction $N^{15}(d,p)N^{16}$, have been measured at $E_d = 2.75$ MeV in the laboratory system. These distributions show strong resemblance to the predictions of stripping theory and have been compared to curves calculated from the formula for the differential cross-section given by Bhatia et al. The most reasonable values of l_n in the reaction leading to the states at 0.113, 0.300,and 0.391 MeV are $l_n = 0,2,$and 0, respectively, indicating spin and parity assignments 0^- or 1^-; $1^-,2^-$, or 3^-; and 0^- or 1^-, respectively, for these three states. A.

539.172.13

1606. AN INVESTIGATION OF THE REACTIONS: $^{10}B(d,n)^{11}C$ AND $^{11}B(d,n)^{12}C$. E.E.Maslin, J.M.Calvert and A.A.Jaffe.
Proc. Phys. Soc. A, Vol. 69, Pt 10, 754-9 (Oct., 1956).

The $B^{10}(d,n)C^{11}$ and $B^{11}(d,n)C^{12}$ reactions have been investigated by bombarding the separated isotopes of B^{10} and B^{11} with a beam of 9 MeV deuterons and analysing the neutron groups with a fast-neutron spectrometer. Angular distributions and cross-sections for a number of neutron groups have been measured. The theory of the stripping process has been applied to assign parities to levels in C^{11} and C^{12} and to obtain information about the spins of these levels. A.

539.172.13

1607. ANGULAR DISTRIBUTION OF NEUTRONS FROM THE REACTIONS $B^{10}(d,n)C^{11}$ AND $N^{15}(d,n)O^{15}$ AT 0.85 MeV BOMBARDING ENERGY. A.Graue.
Univ. Bergen Årbok, 1955, No. 1, 3-7.

Angular distribution and energy spectra of neutrons from the $B^{10}(d,n)C^{11}$ and $N^{14}(d,n)O^{15}$ reactions have been measured at 0.85 MeV bombarding energy, using the photographic plate technique. The experimental results show that both stripping and compound nucleus formation contribute to the angular distributions. A.

539.172.13

1608. NUMERICAL CALCULATION OF NON-COULOMB STRIPPING CROSS SECTION. H.A.Enge and A.Graue.
Univ. Bergen Årbok, 1955, No. 13, 1-17.

A semiclassical description of the stripping process is first given. An angular distribution formula from Friedman and Tobocman's non-Coulomb stripping theory is rearranged

so as to form a convenient basis for numerical calculations. One of the factors in this formula, the "deuteron factor", is given graphically, another function, the "kinetic factor", is tabulated. Charts are also given that facilitate the transformation of experimental cross-sections and reaction angles from the laboratory to the centre-of-mass system. A.

539.172.13

1609. ON THE REACTIONS $B^{10}(d,p)B^{11}$ AND $C^{13}(p,\gamma)N^{14}$. S. Gorodetzky, A.Gallmann and M.Croissiaux.
J. Phys. Radium, Vol. 17, No. 7, 550 (July, 1956). In French.

The gamma–gamma correlation through the 6.23 MeV level of N^{14} is in agreement with spin 1 for this level. The 2.14 MeV level of B^{11} has probably spin 1/2. A.

539.172.3 : 539.152.1

1610. A SIMPLE THEORY OF THE $^7Li(\gamma,{}^3H)^4He$ REACTION. W.Czyż.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 7, 365-8 (1955).

A two-body model of the Li^7 nucleus consisting of an α-particle and a triton is postulated. The interaction between the two is described in terms of a square potential well, the depth of which is a function of the orbital angular momentum of the t-α system. Electric dipole transitions P→S and P→D are most important. Angular distribution measurements lead to the conclusion that the α-particle and triton are attractive in the S state and repulsive in the D state, and the variation in cross-section of the $Li^7(\gamma,H^3)He^4$ reaction for γ-ray energies upnto 20 MeV is discussed on the basis of this assumption. D.R.Chick

539.172.3

1611. ANGULAR DISTRIBUTION OF PHOTONEUTRONS FROM CARBON AND BERYLLIUM. B.P.Fabricand, B.A.Allison and J.Halpern.
Phys. Rev., Vol. 103, No. 6, 1755-7 (Sept. 15, 1956).

The photoneutron angular distributions from carbon and beryllium have been measured by using bremsstrahlung of maximum energies of 23 MeV and 18 MeV, respectively. The results are $1 + (1.35 \pm 0.88)\sin^2\theta$ for carbon and $(1.26 \pm 0.11) + \sin^2\theta$ for beryllium. A.

539.172.3

1612. PHOTOPROTONS FROM Be, C, AND O. L.Cohen, A.K.Mann, B.J.Patton, K.Reibel, W.E.Stephens and E.J.Winhold.
Phys. Rev., Vol. 104, No. 1, 108-14 (Oct. 1, 1956).

The photoprotons ejected from thin foils of beryllium, carbon and polyethylene and from oxygen gas by 25 MeV betatron bremsstrahlung were observed in nuclear emulsions with good resolution. The energy distributions and yields of photoprotons were determined for Be, C and O. Excitation functions for transitions to the ground states of the residual nuclei have been constructed from the observed photoproton energy distributions of C and O. Structure is observed in the proton energy distributions and hence appears in the corresponding (γ,p) excitation functions. This structure is in rough agreement with that observed in (γ,n) reactions in C and O. A.

539.172.3

1613. INELASTIC NUCLEAR SCATTERING OF PHOTONS BY Au^{197}. L.Meyer-Schützmeister and V.L.Telegdi.
Phys. Rev., Vol. 104, No. 1, 185-90 (Oct. 1, 1956).

A lower limit of the total inelastic nuclear photon scattering cross-section of Au was determined as a function of energy by measuring the yield of the reaction $Au^{197}(\gamma,\gamma')Au^{197m}$ (7.5 sec) as a function of betatron energy. The use of pneumatic transfer and of NaI counters in good geometry with 16 gram gold disks as samples enabled one to obtain good counting statistics and detailed decay curves at all betatron energies between 4 and 24 MeV. It is found that the cross-section falls off steeply as soon as the competition from the (γ,n) reaction becomes possible. The maximum cross-section of about 3.5 mb is reached at (7.8 ± 0.2) MeV. This disagrees with earlier work of Cameron and Katz but corresponds qualitatively to the same behaviour as exhibited by $In^{115}(\gamma,\gamma')In^{115m}$ in the recent work of Burkhardt et al. Results indicate a second peak of the cross-section at about 15 MeV, where the giant resonance has its maximum in agreement with recent work of Hayward and Fuller on elastic scattering from gold. These results are compared with the predictions based on the statistical model. It is shown that they can be interpreted most naturally by assuming that below 12 MeV the width for γ-emission is of the order of Weisskopf's estimate for Γ_{E_2} or Γ_{M_1}. Available experimental data on (γ,γ') reactions in other elements are reconsidered in the light of this conclusion. A.

539.172.3

1614. PHOTODISINTEGRATION OF THE DEUTERON BY MESON REABSORPTION. R.R.Wilson.
Phys. Rev., Vol. 104, No. 1, 218-19 (Oct. 1, 1956).

A calculation is made of the photodisintegration of the deuteron which is caused by a meson being photoproduced on one of the nucleons of the deuteron and then subsequently being reabsorbed by the two nucleons. The measured photomeson production cross-sections in hydrogen are separated into S-wave and P-wave parts so that the production of mesons on the neutron can be computed. The probability of meson reabsorption after production is taken as 0.11; this value results from Austern's calculation of the effects of P-state mesons. The effect of virtual production and reabsorption of S-state mesons even below the meson threshold is shown to be very important. Calculated values of the total cross-section agree rather well with the experimentally measured cross-sections. A.

539.172.3

1615. PHOTOFISSION AND PHOTONEUTRON EMISSION IN THORIUM AND URANIUM. J.E.Gindler, J.R.Huizenga and R.A.Schmitt.
Phys. Rev., Vol. 104, No. 2, 425-33 (Oct. 15, 1956).

Yield–energy relations have been determined radiochemically for the photofission and photoneutron reactions in Th^{232} and U^{238}. Excitation functions for the various reactions have been obtained by photon difference analyses of the corresponding yield functions. The photofission branching ratio for excitation energies of 8 to 11 MeV has been calculated to be approximately 0.08 for thorium and 0.2 for uranium. The relative photofissionability of thorium to uranium has been found to be about 2.3 times greater at betatron energies of 7 to 8 MeV than at 20 MeV. Also, evidence for bumps in the photofission excitation functions at about 6 MeV has been observed. Tentative explanations are presented for the relative photofissionability change and the bumps in the excitation functions. Characteristics of crude $(\gamma,2n)$ excitation functions are given for the two nuclides. A.

539.172.3

1616. THE STUDY OF RELATIVISTIC PARTICLES BY THE USE OF NUCLEAR EMULSIONS IN A PULSED MAGNETIC FIELD. V.M.Likhachev, A.V.Kutsenko and V.P.Boronkov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12) 894-5 (1955). In Russian. English translation in: Soviet Physics JETP (New York) Vol. 2, No. 4, 766-7 (July, 1956).

The apparatus consists of a current source, control circuit and a solenoid within which photographic emulsions are placed. The ignitron-controlled current-switching element is fired by a pulse timed so that the field peak coincides with the arrival of the particle beam from the accelerator. Fields of $1\text{-}1.5 \times 10^5$ G could be produced in this way. Measurements were made of the magnetic curvature and multiple scattering of 800 electron pairs produced by photons in an emulsion exposed in a field of 1.2×10^5 G, in order to determine the sign of the charge and the energy of the particles. The mean energy per particle is 43.3 ± 2.7 MeV as determined by the magnetic method, and 46.5 ± 1.7 MeV by the multiple scattering method. Preliminary data on the spectral distribution of the pairs is given. P.Rothwell

539.172.4

1617. INTERPRETATION OF GIANT RESONANCES IN THE ELASTIC SCATTERING OF NEUTRONS BY NUCLEI. L.Verlet.
J. Phys. Radium, Vol. 17, No. 7, 562 (July, 1956). In French.

The Wigner, Lane and Thomas model is generalized so as to lower the second moment of the distribution of the reduced widths to $(9\ \text{MeV})^2$. A.

539.172.4 : 541.48

RUTHENIUM IN REACTOR FUELS AND AS A FISSION PRODUCT. See Abstr. 1714

539.172.4

1618. RADIATIVE CAPTURE CROSS-SECTION OF U^{236}. J.Charon, P.Hubert and R.Joly.
J. Phys. Radium, Vol. 17, No. 7, 564 (July, 1956). In French.

This was re-examined and the value obtained is a confirmation of the authors' first measurement $(24 \pm 7$ b), in disagreement with the value of 9 ± 2 b found by other workers. This discrepancy is tentatively attributed to the effect of the resonances. A.

539.172.4

1619. FLUCTUATIONS OF NUCLEAR REACTION WIDTHS. C.E.Porter and R.G.Thomas.
Phys. Rev., Vol. 104, No. 2, 483-91 (Oct. 15, 1956).

The fluctuations of the neutron reduced widths from the resonance region of intermediate and heavy nuclei have been analysed by a statistical procedure which is based on the method of maximum likelihood. It is found that a chi-squared distribution with one degree of freedom is quite consistent with the data while a chi-squared distribution with two degrees of freedom (an exponential distribution) is not. The former distribution corresponds to a Gaussian distribution for the reduced-width amplitude, and a plausibility argument is given for it which is based on the consideration of the matrix elements for neutron emission from the compound nucleus and of the central limit theorem of statistics. This argument also suggests that within the framework of the compound-nucleus theory all reduced-width amplitudes have Gaussian distributions, and that many of the distributions for the various channels may be independent. One consequence of the latter suggestion is that the total radiation width for a given spin state which is formed in neutron capture will be essentially constant, in agreement with some observations, because it is the sum of many partial radiation widths. The fluctuations of the provisional fission widths of U^{235} are best described by a chi-squared distribution with about $2\frac{1}{2}$ degrees of freedom, indicating that there are effectively only a few independently contributing fission channels. A.

539.172.4

1620. POLARIZATION OF NEUTRONS IN SCATTERING BY LEAD. A.I.Baz'.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 159-61 (1956). In Russian.

The very-small-angle polarization of neutrons, first indicated by Schwinger, is calculated using a realistic nuclear potential and compared with experiment. This comparison indicates a nuclear radius of $\sim 8 \times 10^{-13}$ cm; the results are relatively insensitive to other details of the potential. G.E.Brown

539.172.4

1621. EFFECT OF NEUTRON INTERACTION ON CRITICALITY. G.W.Stuart.
J. appl. Phys., Vol. 27, No. 11, 1294-300 (Nov., 1956).

A general method is developed to allow calculation of the critical buckling of an assemblage of fissile regions coupled by neutron leakage. Consideration is given both to regions embedded in vacuum and in material media. Several cases of simple geometry are further developed to illustrate the theory. A.

539.172.4

1622. STUDY OF THE VARIATION IN THE NUMBER OF NEUTRONS EMITTED BY THE FISSION OF Pu^{239} IN THE THERMAL AND EPI-THERMAL RANGES. J.M.Auclair, M.Jacob and H.Landon.
J. Phys. Radium, Vol. 17, No. 7, 563 (July, 1956). In French.

The study of the variation of the average number of neutrons emitted per fission by Pu^{239} as a function of the energy of the incident neutron shows that within an accuracy of about 1% this number is constant from thermal energy up to several electron-volts. A.

539.172.4

1623. FISSION CROSS-SECTIONS FOR NEUTRONS BETWEEN 1 AND 3 MeV. F.Netter, J.Julien, C.Corge and R.Ballini.
J. Phys. Radium, Vol. 17, No. 7, 565 (July, 1956). In French.

Determination of fast neutron fission cross-sections of U^{233} and Pu^{239} between 1 and 3 MeV with a Van de Graaff accelerator. A.

539.172.4

1624. FISSION CROSS SECTION OF U^{235} FROM 6 TO 2000 eV. M.L.Yeater, W.R.Mills and E.R.Gaerttner.
Phys. Rev., Vol. 104, No. 2, 479-80 (Oct. 15, 1956).

The fission cross-section of U^{235} from 6 to 2000 eV has been measured with a large fission chamber in the KAPL neutron velocity selector. Improved resolution makes it possible to observe fluctuations in the previously unresolved range above 60 eV. A.

539.172.4 : 545

ANALYSIS OF FISSION PRODUCTS Sn AND Sb.
See Abstr. 1719

539.172.4

1625. THE MEASUREMENT OF THE LAPLACIAN IN A LATTICE OF URANIUM METAL RODS AND GRAPHITE. D.V.Booker, W.S.Eastwood, F.W.Fenning, T.M.Fry and E.R.Wiblin.
Atomic Energy Res. Establ. (Harwell) Rep. No. N/R 134, 20 pp. (1956).

The critical size of a pile built up of a particular arrangement of fissile material and moderator can be related to the quantity $\mathcal{H}^2 = (k - 1)/M^2$ which is usually referred to as the Laplacian of the arrangement. In these experiments the Laplacian has been measured for three arrangements in order to check the effect on critical size of (a) a thin annulus of water around the uranium rods, and (b) a 2 cm wide annulus of air around the uranium rods. The arrangement studied consisted of uranium rods of 1.36" diameter spaced at 9" intervals in a block of graphite 10'6" by 10'6" by 9' high, the uranium rods being enclosed in concentric aluminium tubes so that water could be placed in the annular space between the tubes. The method of measurement was to determine thermal neutron densities throughout the structure when a point source of neutrons was placed at the base. Indium foils were used to detect the neutrons and the experimental density distributions were fitted to the expected theoretical form. The constants necessary to give a least-square fit were used to deduce $\mathcal{H}^2$. The results obtained were:

(1) No water present, with air gap $\mathcal{H}^2 = 0.83 \pm 0.03\ m^{-2}$;
(2) No water present, without air gap $\mathcal{H}^2 = 0.90 \pm 0.02\ m^{-2}$;
(3) Water present, without air gap $\mathcal{H}^2 = 0.58 \pm 0.02\ m^{-2}$.

A.

539.172.4

1626. THE DIFFUSION THEORY OF FINE STRUCTURE IN THERMAL NEUTRON REACTOR ASSEMBLIES CONSISTING OF CYLINDRICAL FUEL ELEMENTS SET IN A SQUARE LATTICE ARRAY. A.C.Clark and D.A.Newmarch.
Atomic Energy Res. Establ. (Harwell) Rep. No. RP/R 1657, 18 pp. (1956).

The diffusion theory of fine structure is applied to the case of cylindrical fuel elements set in a square lattice array with special reference to water-moderated natural uranium assemblies. For the cases considered it is found that the simplification of replacing the square cell by a cylindrical cell of the same cross-section area for the purposes of calculation does not introduce any appreciable error. A method of interpreting fine-structure measurements in such lattices is suggested. A.

539.172.4

1627. THE DIFFUSION THEORY OF THERMAL NEUTRON FINE STRUCTURE IN FINITE REACTORS. I. D.A.Newmarch.
Atomic Energy Res. Establ. (Harwell) Rep. No. RP/R 1713, 75 pp. (1956).

By means of diffusion theory expressions for the thermal neutron fine structure are obtained for assemblies consisting of fuel slabs set at a constant distance apart with moderator in between. The expressions are integral in form and the integrals have been solved for certain thermal neutron source distributions. A.

539.172.4

1628. THE DIFFUSION THEORY OF THERMAL NEUTRON FINE STRUCTURE IN REACTORS WITH NON-UNIFORM SPACING OF THE FUEL ELEMENTS. I. D.A.Newmarch.
Atomic Energy Res. Establ. (Harwell) Rep. No. RP/R 1776, 25 pp. (1955).

Expressions for the thermal neutron fine structure, thermal utilization factor, and resonance escape probability are obtained for the case of an infinite reactor where the fuel elements are in the form of slabs which are grouped instead of being uniformly distributed throughout the system. A.

539.172.4

1629. AN ANALYSIS OF CRITICAL ASSEMBLY AND KINETICS DATA OBTAINED FROM THE AIR-SPACED PLUTONIUM CORE ASSEMBLY (CORE II) OF ZEPHYR. A.R.Baker and D.D.McVicar.
Atomic Energy Res. Establ. (Harwell) Rep. No. RP/R 1778, 7 pp. (1956).

The uranium-spaced plutonium core (Core I) used in the first critical assembly of Zephyr has been replaced by an air-spaced core. The subsequent critical assembly, the reactivity calibration of control elements and the kinetic behaviour of the

reactor are described. The decay of the neutron population after shutdown was analysed into five exponentials with periods corresponding to the five groups of delayed neutrons found by Hughes et al. The group of period 1.1 sec found with Core I is assumed to be groups 4 and 5 of Core II unresolved. With this identification there is no significant difference between the delayed neutron groups obtained with Core I and Core II. A.

539.172.4

1630. FISSION-PRODUCT CONCENTRATIONS AND POISONING IN A HOMOGENEOUS REACTOR WITH CHEMICAL PROCESSING. W.H.L.Porter.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R 1889, 46 pp. (1956).

Tables and graphs are presented giving the steady-state fission-product concentrations and total capture cross-sections in the core of a homogeneous reactor for various rates of chemical processing. The results are as general as possible, otherwise they are detailed for the specific system of a liquid metal homogeneous reactor based on uranium dissolved in bismuth. Estimates are also given of the rate of production of inert gases in the main circuit. The transient condition when the reactor is first started up is not considered. A.

539.172.4

1631. ONE-GROUP PERTURBATION THEORY FOR A CYLINDRICAL REACTING CORE. J.Codd.
Atomic Energy Res. Establ. (Harwell) Mem. No. RP/M 45, 10 pp. (1954).

Expressions are obtained for certain integrals which are required in the application of one-group perturbation theory to a cylindrical reacting core. Numerical results are given for the special case of a bare core. As a particular application of the theory, the change in reactivity is investigated when a rod of material is inserted into the core. The analysis is based upon a standard approximate expression for the neutron density distribution in a cylindrical core. A.

539.172.4

1632. FISSION PRODUCT GASES FROM A HOMOGENEOUS POWER REACTOR. P.C.Davidge and C.J.L.Lock.
Atomic Energy Res. Establ. (Harwell) Mem. No. C/M 262, 10 pp. (1955).

The activity, heat release and weight of the fission product gases and their daughter products which will be removed from a 140 MW reactor has been calculated. The way in which these results can be applied to other reactor power levels has been indicated. A.

539.172.4

1633. THE TEMPERATURE COEFFICIENT OF HOMOGENEOUS SPHERICAL REACTORS. C.C.Horton.
Atomic Energy Res. Establ. (Harwell) Mem. No. RP/M 65, 5 pp. (1955).

The temperature coefficient [defined as $(1/K_e)(\partial K_e/\partial T)$, where K_e is the effective multiplication constant] is derived as a function of changes in the nuclear constants and reactor size for a spherical homogeneous reactor with an infinite reflector. It is assumed that the temperature changes in the core and reflector are the same, and that the moderating material is the same in the core and reflector. A.

539.172.4

1634. MATHEMATICS OF FISSION PRODUCT FORMATION IN REACTORS WITH CIRCULATING FUEL. C.J.L.Lock.
Atomic Energy Res. Establ. (Harwell) Mem. No. C/M 278, 16 pp. (1956).

In reactors with circulating fuel the fuel is exposed to intermittent radiation. Formulae are presented enabling the calculation of the amount of any fission product after any time of reactor operation under varying conditions. Formulae are also presented to enable calculation of the amount of fission product gases present in the reactor assuming various efficiencies of removal. A.

539.172.4

1635. THE APPROACH TO CRITICALITY OF ZEUS. K.C.Hines and J.Egerton.
Atomic Energy Res. Establ. (Harwell) Mem. No. RP/M 81, 7 pp. (1956).

The loading of Zeus was carried out in the following way: an outer ring of fuel was inserted first, then loading was commenced at the centre, fuel elements being added in such a way as to close up the gap between the inner cylindrical region of fuel and the outer annular region. In this report the problem of loading a reactor in this way is considered theoretically on the basis of one-group theory. For a series of values of the radius, a, of the central fuel cylinder the appropriate eigenvalue of the system is found and from this the flux just outside the core of the reactor may be calculated. These flux values are plotted as functions of a in various ways and the curves so obtained are compared with the experimentally determined results. A.

539.172.4

1636. SOLUTION OF THE TWO GROUP DIFFUSION EQUATIONS FOR DIMPLE. A. Hassitt.
Atomic Energy Res. Establ. (Harwell) Mem. No. T/M 131, 3 pp. (1956).

The two-velocity-group neutron diffusion equations for a Dimple short-core assembly have been solved by finite difference methods. The difference equations were solved on a Ferranti electronic computer. Complete flux plots for the fast and thermal groups are given. A.

539.172.4 : 536.423.1

1637. EFFECT OF REACTOR FLUX ON BOILING WATER. W.M.Lomer.
Atomic Energy Res. Establ. (Harwell) Mem. No. T/M136, 9 pp. (1956).

The detailed behaviour of any boiling system depends quite strongly on the supply of suitable nucleation sites where small vapour bubbles may form. The highly localized deposition of the kinetic energy of protons and oxygen ions which have been knocked on by the neutron flux in a reactor could serve as a nucleating agent under some circumstances. It is shown here that this could not be expected in water boiling at atmospheric pressure, but that at 600 lb/in^2 it is impossible at present to state whether there will be any such effect, or what its significance as far as heat transport is concerned would be. It is also argued that there is little significance for reactor kinetics in the fact that 5% of the fission energy is carried in long-range neutron and γ-radiation thus by-passing some thermal conduction delays. A.

539.172.4

1638. AN ESTIMATION OF THE DOPPLER EFFECT IN FAST REACTORS. A.M.Lane, J.E.Lynn and J.S.Story.
Atomic Energy Res. Establ. (Harwell) Mem. No. T/M 137, 36 pp. (1956).

A critical examination has been made of the Geneva paper by Feshbach et al.(Fe 55) in an attempt to improve the estimates that these authors make of the temperature coefficient of reactivity in fast reactors. In contrast to Fe 55, the numerical estimates in this report are based on certain assumed statistical distributions of the resonance level parameters. This means that only the thermal neutron data of U^{235} and U^{238} are used to obtain mean values of the parameters. It turns out that the results are quite sensitive to the mean values which are not very well known at present. Because of this and other uncertainties, the numerical estimates given in the report are not quantitatively reliable. Attention is drawn to certain laboratory experiments which should, in principle, give a direct measurement of the required temperature coefficient. A.

539.172.4 : 539.21

1639. FAST-NEUTRON DAMAGING IN NUCLEAR REACTORS: ITS KINETICS AND THE CARBON ATOM DISPLACEMENT RATE. W.Primak.
Phys. Rev., Vol. 103, No. 6, 1681-92 (Sept. 15, 1956).

It is shown that the radiation damage produced in graphite at near room temperature is labile. A theory describing this lability is developed. Then using this theory and an identification and determination of the portion of the neutron flux spectrum responsible for the damage as obtained in another paper, the displacement rates for the condition that no annealing had intervened are calculated from the number of displacements which had been determined in graphite samples which had been irradiated near room temperature. From several different methods there is obtained, within a factor of 2, the following

result: 10^{-21} displacements atom per damaging neutron/cm² for the number of displacements which remain after a scattering event involving a fast neutron near the beginning of the irradiation under conditions in which thermal annealing is not occurring. A.

539.172.4 : 518.5

COMPUTING NEUTRON DIFFUSION EQUATIONS FOR HOMOGENEOUS REACTORS. See Abstr. 1001

ATOM AND MOLECULE BEAMS. MESONS. NEUTRONS 539.18

539.18

1640. PAIS–PICCIONI EXPERIMENT. K.M.Case.
Phys. Rev., Vol. 103, No. 5, 1449-53 (Sept. 1, 1956).

Two experiments to check the Gell-Mann–Pais "particle mixture" suggestion for θ^0-meson are analysed, by using a detailed, if crude, phenomenological description. A cloud-chamber experiment of the type proposed by Pais and Piccioni is compared to an experiment using a liquid xenon bubble chamber. It is found that for likely values of the parameters involved, both experiments are considerably more difficult than envisaged by Pais and Piccioni. For intensity reasons, the bubble-chamber experiment seems preferable. However, if accidentally the relevant cross-sections have rather special values, experiments of this type would be particularly easy. A.

539.18

1641. DIAGRAMS FOR PROCESSES INVOLVING HYPERONS. J.Tiomno.
Phys. Rev., Vol. 103, No. 5, 1589-90 (Sept. 1, 1956).

A graphical notation is suggested which automatically conserves charge, nucleon number, and isofermion number. P.T.Matthews

539.18

1642. ISOTOPIC INVARIANCE AND STRANGE PARTICLES. L.B.Okun'.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1172-3 (1956). In Russian.

Relations between cross-sections from charge invariance are discussed for a large number of hyperon reactions. G.E.Brown

539.18 : 530.145

A COMPOSITE MODEL FOR HYPERONS. See Abstr. 1058

539.18

1643. SOME STUDIES ON HEAVY MESON EVENTS IN STRIPPED EMULSIONS. J.K.Bøggild, J.E.Hooper, W.C.G.Ortel and M.Scharff.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 30, Paper 3, 28 pp.(1955).

An account is given of 17 K-meson events found in half a stack of stripped emulsions exposed during the Sardinia expedition of 1953. Evidence is presented for the mode of decay $K_\mu \rightarrow \mu + \nu$, where the μ-meson is emitted with $p\beta c = (224 \pm 7)$ MeV, and the best mass of the K_μ-meson is $(990 \pm 16)\, m_e$. An example of χ-decay is also reported and discussed. A.

539.18

1644. THE DECAY AND DIFFERENCE IN MASS OF HEAVY NEUTRAL MESONS. Ya.B.Zel'dovich.
Zh. eksper. teor. Fiz., Vol. 30, No. 6, 1168-9 (1956). In Russian.

Several differences in the behaviour of the symmetric and antisymmetric θ-particles with respect to charge conjugation are noted. In particular, the number of $\mu^+\pi^-\nu$ and $\mu^-\pi^+\nu$ decays varies with distance. G.E.Brown

539.18

1645. ANGULAR CORRELATION IN THE CASCADE DECAY OF HYPERONS. V.B.Berestetskiĭ and V.P.Ignatenko.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1169-71 (1956). In Russian.

Angular correlation in the planes of the processes $\Sigma^0 \rightarrow \Lambda^0 + \gamma \rightarrow p + \pi^- + \gamma$ is studied. G.E.Brown

539.18

1646. NEW DECAY MODE OF A HEAVY MESON?
O.A. Shakhulov, N.A. Kebuladze, É.L. Andronikashvili and K.A.Abashidze.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 167-8 (1956). In Russian.

Im emulsions exposed at 25-27 km, three cases of decay of a particle giving a visible π-meson of energy 3.4 MeV were observed. Since all the three π-mesons had the same energy, this is indicative of a two-body decay. Possible variants are: (1) $?^\pm \rightarrow \pi^\pm + \pi^\circ + Q$; (2) $?^\pm \rightarrow \pi^\pm + \theta^\circ + Q$; (3) $?^\pm \rightarrow \pi^\pm + \nu + Q$; (4) $K^\pm \rightarrow \pi^\pm + ?^\circ + Q$. G.E.Brown

539.18 : 539.166.2

π^0-MESON DECAY. See Abstr. 1570

539.18 : 537.534.74

1647. π^+–p SCATTERING AT 10-35 MeV IN A DIFFUSION CLOUD CHAMBER. M.H.Alston, W.H.Evans, M.Fidecaro, R.W.Newport, G.von Gierke and P.R.Williams.
Proc. Phys. Soc. A, Vol. 69, Pt 11, 798-803 (Nov., 1956).

An investigation has been made of π^+–p scattering at incident pion energies of $20(^{+15}_{-10})$ MeV, using a hydrogen-filled diffusion cloud chamber in a magnetic field. Fifteen π^+–p scattering events were observed and the incident pion spectrum and path length were determined from measurements on $\pi-\mu$ decays. The results were analysed by using the values for the phase shifts $\alpha_{33} = 0.235\eta^3$, $\alpha_{31} = 0$ and assuming that α_3 is directly proportional to η. The phase shift α_3 was then found to be $-(0.13 \pm 0.035)\eta$ radians, where η is the pion momentum in mass units. A.

539.18

1648. INTERACTION OF π-MESONS WITH π-MESONS. Z. Koba.
Progr. theor. Phys., Vol. 15, No. 3, 294-5 (March, 1956).

It is suggested that the $\pi-\pi$ cross-section inferred from Cosmotron results is not inconsistent with that derived from cosmic ray data using the Landau theory of multiple scattering thus giving support to the latter theory. J.S.Bell

539.18 : 537.591.1

MOMENTUM SPECTRUM OF μ-MESONS. See Abstr. 1428

539.18 : 539.172

π^--MESON ABSORPTION IN Be AND C. See Abstr. 1583

539.18

1649. PRODUCTION OF π-MESON PAIRS BY γ-RAYS AND BREMSSTRAHLUNG OF π-MESONS ON NUCLEI. Yu.A.Vdovin.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 947-50 (1955). In Russian.

Results of Landau and Pomeranchuk for these processes, in which it was assumed that the nucleus was black, are generalized to the case of partly transparent nuclei, i.e. for obtaining the π-meson wave-functions the nucleus is replaced by a complex potential. G.E.Brown

539.18 : 539.172.13

1650. MAGNETIC ANALYSIS OF THE REACTIONS $pp \rightarrow np\pi^+$ (I), $pp \rightarrow pp\pi^0$ (II) AND $pp \rightarrow d\pi^+$ (III) at 660 MeV. M.G.Meshcheryakov, B.S.Neganov, I.K.Vzorov, V.P.Zrelov and A.F.Shabudin.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 499-502 (1956). In Russian.

Off-coming protons are analysed magnetically, so that their momentum distribution is obtained at laboratory angles of 7^0-30^0. The high momentum protons are strongly anisotropic, indicating that they come from nucleon–meson isobars (T = 3/2, j = 3/2 state) formed with the maximum excitation possible. G.E.Brown

539.18

1651. PROPERTIES OF HEAVY UNSTABLE PARTICLES PRODUCED BY 1.3-BeV π^- MESONS. R.Budde, M.Chretien, J.Leitner, N.P.Samios, M.Schwartz and J.Steinberger.
Phys. Rev., Vol. 103, No. 6, 1827-36 (Sept. 15, 1956).

A propane bubble chamber has been exposed to a π^- beam of 1.3 BeV kinetic energy. The reactions $\pi^- + p \rightarrow \Sigma^- + K^+$, $\pi^- + p \rightarrow \Lambda^0 + \theta^0$, $\pi^- + p \rightarrow \Sigma^0 + \theta^0$, can be experimentally distinguished from carbon events. Results based on the first 55 such events are presented. The centre-of-mass production distribution of the Σ^- is peaked forward, that of the Λ^0 backward. No large anisotropies in the angular correlation of production and decay were found, so that there is no evidence for spin in excess of $\frac{1}{2}$ for any of the three particles: Σ^-, Λ^0, or

θ^0. A study of the relative abundance of single and double V production indicates that both Λ^0 and θ^0 have either long-lived "states" or neutral decay modes. A statistical analysis gives $\overline{\alpha}_{\Lambda 0} = 0.3_{-0.12}^{+0.15}$, $\overline{\alpha}_{\theta 0} = 0.3_{-0.12}^{+0.19}$, for the normal charged decay probabilities ($\Lambda^0 \rightarrow \pi^- + p$; $\theta^{0'} \rightarrow \pi^+ + \pi^-$) of the Λ^0 and θ^0, respectively. One event was analysed to obtain the energy released in Σ^- decay. $\Sigma^- \rightarrow \pi^- + n + Q$; $Q = 118 \pm 2.6$ MeV. The Σ^- lifetime on the basis of 16 decays is $(1.4_{-0.5}^{+1.6}) \times 10^{-10}$ sec. A.

539.18

1652. MESON PRODUCTION BY ELECTRONS. R.B.Curtis.
Phys. Rev., Vol. 104, No. 1, 211-17 (Oct. 1, 1956).

The differential cross-section for the production of mesons by electrons has been calculated to first order in the fine structure constant as a function of the meson angle and energy. It is possible to split the transition probability into two terms, one of which is proportional to the photomeson differential cross-section (the Williams–Weizsäcker approximation), the other containing longitudinal current and other corrections. Experimental cross-sections were used in the first term and the correction term was calculated using the Chew–Low theory. The cross-section was calculated on the Illiac electronic digital computer for seven electron energies from 350 MeV to 560 MeV, for meson energies at intervals of 15.5 MeV, and for meson angles of 45°, 90° and 180° in the laboratory system. A.

539.18

1653. A STUDY OF POSITIVE PION PRODUCTION IN p–p COLLISIONS AT 383 MeV. M.H.Alston, A.V.Crewe, W.H.Evans and G.von Gierke.
Proc. Phys. Soc. A, Vol. 69, Pt 9, 691-704 (Sept., 1956).

An 18 in. diffusion cloud chamber filled with 28 atmospheres of hydrogen and in a magnetic field of 11 200 gauss is used to investigate the production of π^+-mesons in p–p collisions at 383 MeV. The energy resolution is of the order of 2 MeV and the spectrum obtained can be divided into mesons from the "bound" and "unbound" reactions. The angular distributions found are

$$\frac{d\sigma}{d\omega}(\text{bound}) \propto (0.19 \pm 0.06) + \cos^2\theta' \text{ and } \frac{d\sigma}{d\omega}(\text{unbound}) \propto (0.21 \pm 0.07) + \cos^2\theta'.$$

The branching ratio σ (unbound)/σ (total) = (47 ± 8)%. The shape of the unbound spectrum is not in agreement with that predicted by the phenomenological theory but this spectrum and also the high experimental branching ratio can be explained by the inclusion of a term $\sigma_{10}''(Pp) \cong 1.2\eta_{max}^8$ in the theory. A.

539.18

1654. CHARGE DISTRIBUTION OF MESONS IN NUCLEON–ANTINUCLEON ANNIHILATION. A.I.Nikishov.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1149-50 (1956). In Russian.

Using only conservation of total isotopic spin, the distribution of charged mesons for a given multiplicity (4 or 5) of production is given. G.E.Brown

539.18

1655. ON THEORIES OF MULTIPLE MESON PRODUCTION. L.G.Yakovlev.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 142-4 (1956). In Russian.

The maximum energy consistent with the laws of conservation of energy and momentum that a given particle can have, is calculated and shown on graphs. G.E.Brown

539.18 : 537.123

π-MESON PRODUCTION IN ANTIPROTON ANNIHILATION.
See Abstr. 1243

539.18 : 539.172.13

PRODUCTION OF MESONS IN Be AND C BY PROTONS.
See Abstr. 1598

539.185 : 535.14

1656. ON THE QUESTION OF THE SCATTERING OF PHOTONS BY NEUTRINOS. G.Marx.
Acta phys. Hungar., Vol. 5, No. 3, 357-8 (1955). In German.

The possibility of photons being scattered by neutrinos is examined. Such scattering might be of great importance astronomically. An estimate of 10^{-60} cm^2 is given for the cross-section which is not very different from the cross-section for photon-photon scattering. D.J.A.Prowse

539.185

1657. ON A 14 MeV NEUTRON GENERATOR INTENDED FOR THE STUDY OF THE INELASTIC SCATTERING OF NEUTRONS. C.Magnan.
J. Phys. Radium, Vol. 17, No. 7, 592-3 (July, 1956). In French.

A description is given of a new tube, accelerating tritium ions up to 150 keV: the design uses the T(d,n)He^4 reaction which produces 14 MeV neutrons. A 1 mA triton current hits an aluminium target loaded with deuterium. A direct measurement of the alpha particles produced in the reaction is obtained from a photomultiplier fitted out with an organic phosphor, thus indicating the absolute intensity of the neutron emission. This design, moreover makes it possible to get alpha–neutron coincidences, with a view to the measurement of the inelastic cross-sections. A neutron emission of about 10^{10} neutrons per second is expected from the results of the first trials. A.

539.185

1658. MAGNETIC MOMENT OF THE NEUTRON. V.W.Cohen, N.R.Corngold and N.F.Ramsey.
Phys. Rev., Vol. 104, No. 2, 283-91 (Oct. 15, 1956).

An experiment has been performed to measure the magnetic moment of the neutron to a greater precision that has heretofore been obtained. The method is somewhat similar to that of atomic-beam magnetic resonance using separated oscillating fields. A beam of slow neutrons is polarized by reflection from a magnetized cobalt mirror and then reflected again from a similar mirror used as an analyser. Between the two mirrors the neutrons pass through a region of uniform magnetic field where they may become depolarized by a resonant r.f. magnetic field. This results in a drop in intensity of neutrons reflected from the second mirror. The resonance frequency for depolarization is compared with the proton moment resonance frequency in the same transition region. In order to achieve high resolution of the neutron resonance, the path length of the neutrons in the uniform magnetic field was 110 cm. The measured ratio of resonant frequencies $\nu_n/\nu_p = 0.685\,057 \pm 0.000\,017$. This corresponds to a value of $\mu_n = -1.913\,148 \pm 0.000\,066$ n.m. A.

539.185

1659. THE SCATTERING OF 130 MeV NEUTRONS BY PROTONS. T.C.Randle, D.M.Skyrme, M.Snowden, A.E.Taylor, F.Uridge and E.Wood.
Proc. Phys. Soc. A, Vol. 69, Pt 10, 760-6 (Oct., 1956).

The differential cross-section for the scattering of neutrons by protons has been measured at an effective neutron energy of 130 MeV using a diffusion cloud chamber. An asymmetrical distribution with a minimum at a scattering angle of about 80° in the centre-of-mass system was obtained. This is in contrast to the near symmetry about 90° indicated by measurements at 90 MeV and with the observation of a minimum at about 100° at higher energies. A.

539.185

1660. POLARIZATION OF NEUTRONS SCATTERED BY CARBON TAKING INTO ACCOUNT THE NUCLEAR VOLUME. N.A.Guliev.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 144-6 (1956). In Russian.

The spin-orbit potential is taken as proportional to $d\varphi/dr$, where φ is the solution of $(\nabla^2 - k_0^2)\varphi = -4\pi\rho$ and ρ is the nucleon density. Because of the smooth transition to zero of φ at the edge of the nucleus, good agreement with experiments (scattering of 290 MeV protons) is obtained. G.E.Brown

539.185 : 537.534.74

NUCLEON–NUCLEUS INELASTIC SCATTERING.
See Abstr. 1396

539.185.08

1661. "TWIN" SCINTILLATION FAST NEUTRON DETECTOR. I.B.Berlman and L.D.Marinelli.
Rev. sci. Instrum., Vol. 27, No. 10, 858-9 (Oct., 1956).

Two organic scintillating solutions, containing the same total number of electrons, but differing by more than a fourfold in the total number of hydrogen atoms, are used to detect neutrons in the presence of a gamma-ray background. By suitable adjustments of their luminescence their pulse-height spectra can be made by coincide in the presence of gamma radiation; hence by subtracting the spectrum of one solution from that of the other it is possible to obtain the pulse height spectrum due to the excess of proton recoils in the latter. Although refinements in the interpretation of its response must wait for basic information on the luminescent efficiency of both protons and electrons of various energy, this detector is simple to build,

stable in time, isotropic in response, and suitable to evalualte radiation hazards in the presence of mixed radiations. Typical responses o gamma radiation, D-D, and D-T neutrons are presented. A.

539.185.7

1662. APPROXIMATE DETERMINATION OF NEUTRON SPECTRUM FOR THE CASE OF $1/v^{\alpha}$-ABSORPTION CROSS-SECTION. M.E.Mandl.
Atomic Energy Res. Establ. (Harwell) Rep. No. T/R 560, 13 pp. (1955).

An approximate formula is derived for the neutron absorption energy spectrum in an infinite medium of a pure substance for which $\sigma_a/\sigma_{sc} \propto 1/v^{\alpha}$ (where σ_a, σ_{sc} are the absorption and scattering cross-sections, respectively, v = neutron velocity and $\alpha > 0$), and an estimate is made of the relative error incurred in using this approximation to evaluate certain types of integrals over the neutron absorption energy spectrum. These integrals include the probability for a neutron to be absorbed before reaching energy E and integrals such as those considered in A.E.R.E. T/R 528 (B.Davison) and A.E.R.E. T/R 529 (M.E.Mandl). A.

STRUCTURE OF SOLIDS 539.2

539.21

1663. PHASE CHANGES IN PILE-IRRADIATED URANIUM-BASE ALLOYS. M.L.Bleiberg, L.J.Jones and B.Lustman.
J. appl. Phys., Vol. 27, No. 11, 1270-83 (Nov., 1956).

Specimens of U-9, -10.5, -12, and -13.5 w/o (weight percent) Mo and U-10 w/o Nb, heat treated to retain the metastable gamma phase at room temperature and also to transform this phase to the room temperature stable phases, were irradiated at maximum temperatures of less than 200°C. Electrical resistivity, temperature coefficient of electrical resistivity, hardness, and density measurements as well as X-ray diffraction patterns indicated that the stable phases at room temperature reverted to the metastable gamma phase during irradiation. No apparent changes in the microstructures of thermally transformed specimens were observed after irradiation. Lack of observable microstructural changes was attributed to the development of a ghost structure. X-ray line broadening measurements indicated essentially complete homogenization of thermally transformed U-Mo alloy specimens during irradiation. The mechanism of the phase reversal was explained on the basis of the displacement spike hypothesis. A.

539.21 : 666

1664. RADIATION COLORATION IN GLASSES. M.Levy.
J. Soc. Glass Technol., Vol. 40, No. 192, 18 T - 24 T (Feb., 1956).

Radiation coloration in ordinary glasses has been proposed as being due to a superposition of several absorption bands, each one having characteristics similar to those of an alkali halide F-band. The centres in glass are referred to as G-centres and each centre is proposed as being due to an electron trapped at an oxygen ion vacancy in the neighbourhood of a particular group of one of the many cations in the glass. Inhibition to coloration may take place by the addition of specific amounts of a cation of high valency to the glass melt, while sensitization occurs when very low additions are made. These phenomena are similar to those observed in the alkali halides, and models have been proposed by the author to explain them in the case of glasses. A.

539.21

1665. STRUCTURE OF NEUTRON-DISORDERED SILICA.
I. Simon.
Phys. Rev., Vol. 103, No. 5, 1587-8 (Sept. 1, 1956).

The electron radial distribution functions were obtained from X-ray diffraction patterns of neutron irradiated (dose 1.4 x 10^{20} n/cm^2) quartz and vitreous silica, and unirradiated fused quartz. The first two were identical, perceptibly different from the last. Interatomic distances and angles are given. J.Adam

539.215.08

1666. A PORTABLE INSTRUMENT FOR RESPIRABLE DUST SAMPLING. R.J.Hamilton.
J. sci. Instrum., Vol. 33, No. 10, 395-9 (Oct., 1956).

Dust-laden air is drawn into the instrument, which is known as the long running thermal precipator, by means of a clock-work driven diaphragm pump. Passage through a horizontal elutriator removes all but the respirable fraction which is then deposited on a single horizontal microscope slide by a combination of gravity settlement and thermal precipitation. A single sample covers up to eight hours operation, giving a measure of average dustiness. Evaluation is normally by visual microscopy, but the method of collection employed provides a deposit particularly well suited to bulk evaluation techniques. The instrument is "intrinsically safe" for use in gassy coal mines, self-contained, and simple to operate. Extended pit trials have proved it to be robust and reliable and to give results in agreement with those obtained by the conventional thermal precipitator. A.

539.216.1 : 548.735

1667. CORRECTION FACTOR FOR THE QUANTITATIVE DETERMINATION OF FIBER TEXTURE. W.P.Chernock, J.Singer, M.H.Mueller and P.A.Beck.
J. appl. Phys., Vol. 27, No. 10, 1170-2 (Oct., 1956).

Experimental texture data were collected for a titanium and a uranium rod in order to test the applicability of the $\sin\phi$ correction factor to be used with pole charts for fibre textures. Comparison of the corrected and uncorrected integrated intensity values for pole charts corresponding to various reflections with the calculated intensity values indicates that the agreement is greatly improved when the $\sin\phi$ correction factor is used. A.

539.217

1668. DIFFUSION OF BORON, CARBON AND NITROGEN IN TRANSITION METALS OF GROUPS IV, V, AND VI OF THE PERIODIC SYSTEM. G.V.Samsonov and V.P.Latÿsheva.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 582-5 (1956). In Russian.

A study of the diffusion of B, C, and N into Ti, Zr, Nb, Ta, Mo, and W shows that the energies of activation for their diffusion increase with increase of the atomic number of the metal within the same group, that for the same metal they increase in the order B, C, and N, and that the energies for diffusion of C into elements of group VI are considerably greater than those for groups V and IV, there being hardly any difference for B. Diffusion equations, and compounds formed in the diffusion of B and C, are given and the results are discussed. R.C.Murray

539.217

1669. DIFFUSION OF GOLD IN SINGLE CRYSTALS OF SILVER. F.E.Jaumot, Jr and A.Sawatzky.
J. appl. Phys., Vol. 27, No. 10, 1186-8 (Oct., 1956).

The diffusion of Au in Ag has been measured in the temperature range from 650 to 950°C, using Au^{198} as a tracer. The data indicate that the diffusion coefficient is given by the equation $D = 0.26 \exp(-45\,500/RT)$ cm^2/sec. The fact that the activation energy for the diffusion of Au in Ag is identical to that for self-diffusion in Ag is discussed briefly. A.

539.217 : 548

1670. RATES OF SURFACE SELF-DIFFUSION OVER THE PRINCIPAL PLANES OF A SINGLE CRYSTAL OF COPPER. N.Hackerman and N.H.Simpson.
Trans Faraday Soc., Vol. 52, Pt 5, 628-33 (May, 1956).

Using radioactive copper and large single crystals of copper a surface self-diffusion study was made of copper on the (100), (110) and (111) planes. The diffusion coefficients (D in cm^2 sec) were found to be of the order of 10^{-5} but differed measurably on the three planes as well as along different axes of the (100) plane. There was also a suggestion of such an effect along different axes of the (110) plane but none with the (111) plane. A mechanism is suggested to explain these results. A.

539.217

1671. CORRELATION FACTORS FOR DIFFUSION IN SOLIDS. K.Compaan and Y.Haven.
Trans Faraday Soc., Vol. 52, Pt 6, 786-801 (June, 1956).

The relation of Einstein, $D = BkT/e$, relating the diffusivity and mobility of particles (ions or atoms) must be altered where D is the diffusion constant of tracers in solids, if a vacancy mechanism holds, because there will be a correlation between successive steps of a particle, even if the steps of the vacancies themselves are uncorrelated. Certain symmetry

conditions being fulfilled, the relation of Einstein must be extended with a correlation factor

$$f = (1 + \overline{\cos\theta}_{i,i+1})/(1 - \overline{\cos\theta}_{i,i+1}),$$

where $\theta_{i,i+1}$ is the angle between two successive steps of a particle. The diffusion problem can be translated into the theory of electrical networks and with the help of measurements in a resistor network the value of $\overline{\cos\theta}_{i,i+1}$ is easily evaluated. This has been done for several types of lattices. Other cases, where the equation does not hold, because of lack of symmetry, are treated by similar methods. Appropriate substitutions having been made, the diffusion of associated pairs has been treated as the diffusion of a single particle in a so-called transposed lattice. A.

539.217.3

1672. EQUILIBRIUM BETWEEN GLASS AND WATER VAPOR AT BAKE-OUT TEMPERATURES. B.J.Todd.
J. appl. Phys., Vol. 27, No. 10, 209-10 (Oct., 1956).

The diffusion of water from glass is shown to be a reversible process. The equilibrium partial pressure of water for a soda-lime glass was 10 mm of Hg at 500°C and 12 mm of Hg at 550°C. In a very dry atmosphere the diffusion of water from the glass proceeded as well as in vacuum. A.

539.218

1673. THE COMPACTABILITY OF POWDERS OF THE BORIDES, CARBIDES AND NITRIDES OF THE REFRACTORY METALS. G.V.Samsonov and V.S.Neshpor.
Dokl. Akad. Nauk SSSR, Vol. 104, No. 3, 405-8 (1955). In Russian. English translation in Atomic Energy Res. Establ. (Harwell) Transl. 641, 3 pp. (1956).

The apparent electrical conductivity (a) was determined for briquettes of WC, TiC, ZrC, TiB_2, ZrB_2, TiN and ZrN, and related to the relative density θ (= apparent density of briquette/density of powder material) giving the formula $a = K \exp(-A/\theta)$ where A and K are constants. The equation held for the degree of compaction from 35 to 86% relative density. A in the equation appeared to characterize the tendency to brittle rupture and was taken as the brittleness factor. The brittleness did not correlate with the microhardness number. It is suggested that hardness depends on the bond energy of the crystal lattice, while brittleness depends on the capacity of the atoms in a crystal lattice to displace in deformation without destruction of the interatomic bonds (i.e. without fracture of the material). Values were quoted for the relative widening of the lattice of the corresponding transition metal in conversion to the carbide, and the greatest widening occurred with the highest value of the brittleness factor A. There was no similar clear correlation for the borides and nitrides. A.C.Whiffin

539.219

1674. THE AUSTENITE : PEARLITE REACTION. R.F.Mehl and W.C.Hagel.
Progress in metal physics, Volume 6, 74-134. See Abstr. 7097 (1956).

A review of the austenite–pearlite reaction in eutectoid Fe–Fe_3C alloys. Discusses the thermodynamics of the reaction, the quantitative treatment of the nucleation and growth process, the physical and structural properties of pearlite, and their interpretation, and the mechanism of the formation of austenite from Fe_3C–ferrite aggregates. 85 references. E.P.Wohlfarth

539.219

1675. GERMANIUM SOLIDUS CURVES. C.D.Thurmond, F.A.Trumbore and M.Kowalchik.
J. chem. Phys., Vol. 25, No. 4, 799-800 (Oct., 1956).

Solidus and distribution coefficient curves are given for Al, Ga, In, Sn, As, Sb and Zn in Ge. Methods for measuring low temperature solubility and distribution coefficients are briefly described. J.Franks

539.219

1676. ELECTRONIC THEORY OF LOCAL ORDER. P.A.Flinn.
Phys. Rev., Vol. 104, No. 2, 350-6 (Oct. 15, 1956).

The application of the perturbed free-electron approximation to a binary metallic solid solution leads to an expression for the energy which includes a term dependent on the local order. As a consequence of this term, and in the absence of other effects, short-range order is predicted for solid solutions with an electron/atom ratio of about one, and clustering for solid solutions with an electron/atom ratio between two and three. The sign and order of magnitude of the effect observed in several alloys where this approach may be appropriate is consistent with that calculated by this method. A.

539.23 : 535.417

1677. CALCULATOR FOR THIN FILM MEASUREMENTS. W.A.Feibelman.
J. Opt. Soc. Amer., Vol. 46, No. 11, 994-5 (Nov., 1956).

The design and operation of a calculator for determining thin film thicknesses measured by the multiple beam interferometer method is described. A photograph of the instrument and layout of the calculator dial is included. A.

539.231

1678. THE PROPERTIES OF SOME REACTIVELY SPUTTERED METAL OXIDE FILMS. L.Holland and G.Siddall.
Vacuum, Vol. 3, No. 4, 375-91 (Oct., 1953; publ. Dec., 1955).

Some of the recent applications of reactively sputtered metal oxide films for electrical and optical purposes are described. A series of conducting oxides approximating to the compositions cadmium oxide (CdO), tin oxide (SnO_2), indium oxide (In_2O_3) and iron oxide (Fe_3O_4) have been prepared and their respective properties are discussed in relation to their use as transparent conducting coatings on glass windows. It is shown that the electrical conductivity of sputtered cadmium oxide films decreases as the degree of oxidation of the deposit rises. The conductivity of a highly oxidized deposit can be greatly increased by heating the film in air to cause a partial dissociation of the oxide. Cadmium oxide films of the highest conductivity may also be produced directly by careful control of the glow discharge and residual gas mixture during sputtering. The method of preparing gold films of compact structure by using bismuth oxide substrates due to Preston and Gillham has been investigated, and their results confirmed. Gold films of 100 A thickness on bismuth oxide are shown to have a low resistivity (10 ohm per square) and a high optical transmission (75 per cent). Values of the resistivity and temperature coefficient of resistance of gold-films on bismuth oxide are given for films 20/200 A thick in the temperature range 15/150°C. It is shown that the temperature coefficient decreases with the film thickness and can be related to a rise in the resistivity of the deposit. The optical transmission and resistivity of typical coatings of each of the above materials are given in tabular form. A.

539.232

1679. DETERMINATION OF THE OXIDE FILM THICKNESS ON TIN. F.W.Salt and J.G.N.Thomas.
Nature (London), Vol. 178, 434-5 (Aug. 25, 1956).

Electrometric reduction was found to be a suitable method for this determination because of the high hydrogen overpotential. Assuming that the film consists of stannous oxide film, thicknesses of 15 and 20 A are found on tin which has been exposed to the air for 1 hour and 19 hours respectively. W.Good

539.26

1680. QUANTITATIVE STUDY OF SUBSTRUCTURE CHARACTERISTICS AND CORRELATION TO TENSILE-PROPERTY OF NICKEL AND NICKEL ALLOY. S.Weissmann.
J. appl. Phys., Vol. 27, No. 11, 1335-44 (Nov., 1956).

The application of a method combining X-ray microscopy and diffraction analysis to the study of the substructure of nickel and nickel alloys disclosed the coexistence of three orders of magnitude of substructural entities. These three orders are structurally interrelated and distinguished by different ranges of size, disorientation angle, and lattice misalignment. The statistical analysis of the data disclosed that for the two largest orders of substructural entities increasing amounts of room temperature deformation cause (1) a decrease in the mean size and a decrease in the spread of the size distribution, (2) an increase in the mean disorientation angle between substructural entities of the same order and an increase in the spread of the distribution of angles, and (3) an increase in the mean lattice misalignment and spread in the distribution of misalignment. Progressive room temperature deformation causes the low-angle boundaries to become increasingly unsymmetrical and greatly increases the number of the smallest substructural entities. The rise of flow stress as a function of room temperature deformation was correlated to the systematic modification of substructure characteristics. A.

539.27 : 548.74

1681. INTERFERENCE EFFECTS IN THE ELECTRON MICROSCOPY OF THIN CRYSTAL FOILS. W.Bollman.
Phys. Rev., Vol. 103, No. 5, 1588-9 (Sept. 1, 1956).

The electron microscopy of thin foils of chrome-nickel steel re-

veals surface roughness, slip lines, lattice distortions and grain boundaries. Such interference effects should prove useful in the study of metals and of semiconductors. R.Reed

ELASTICITY. STRENGTH. RHEOLOGY

539.3/.8

539.31 : 548.7

1682. DISLOCATION DAMPING. J.Weertman and E.I.Salkovitz.
J. appl. Phys., Vol. 27, No. 10, 1251 (Oct., 1956).

A reply to a criticism which Granato and Lücke (Abstr. 5455/1956) have raised concerning previous work (Abstr. 3205/1955). A calculation is given which demonstrates that, even at the lowest strain amplitudes (5×10^{-8}) used in damping experiments, the amplitude of vibration of dislocation loops may be considerably larger than the interatomic distance. The authors' dislocation damping model is justified for impurity concentrations as low as 10^{-6}, although it breaks down for superpure crystals. J.G.Oldroyd

539.31

1683. INTERNAL FRICTION PEAKS ASSOCIATED WITH THE STRESS-INDUCED DIFFUSION OF CARBON IN FACE-CENTERED CUBIC ALLOY STEELS AND METALS. T.-S.Kê, and C.-M.Wang.
Scientia Sinica, Vol. 4, No. 4, 501-18 (Dec., 1955).

Internal friction peaks associated with the presence of carbon in several types of face-centred cubic alloy-steel (18/8 type stainless steel and high manganese steel) have been observed from measurements with a torsion pendulum. The temperature for maximum internal friction lies between 200° C and 300° C with a frequency of vibration of about one cycle per second. The height of the peak rises and the position of the peak shifts to a lower temperature with an increase of the carbon content. When the amount of carbon in solid solution is reduced by tempering the specimen at an elevated temperature, the height of the peak lowers and the peak shifts to a higher temperature. A comparison of the activation energy and the diffusion coefficient determined by internal friction methods with those measured in conventional macro-diffusion experiments reveals that the observed internal friction peak is associated with the stress-induced diffusion of carbon in these face-centred cubic steels. Internal friction peaks associated with the stress-induced diffusion of carbon in a Ni—Al alloy and in pure nickel have also been observed. These experiments show that the appearance of an internal friction peak associated with the diffusion of carbon in f.c.c. metals may be a general phenomenon. A.

539.31

1684. ON THE INTERNAL FRICTION PEAK ASSOCIATED WITH THE PRESENCE OF CARBON IN NICKEL. T.-S.Kê, C.-T.Tsien and K.Míšek.
Scientia Sinica, Vol. 4, No. 4, 519-26 (Dec., 1955).

Describes experiments which demonstrate conclusively that this internal friction peak is not connected with ferromagnetism of nickel but depends upon the amount of carbon in solid solution in nickel. More accurate determinations of the activation energy associated with this internal friction peak show that this activation energy is indeed very close to the activation energy for the diffusion of carbon in nickel. These experiments thus show that the new internal friction peak is associated with the stress-induced micro-diffusion of carbon in nickel. A brief discussion on the mechanism of this internal friction peak in terms of the existence of holes in the crystal lattice of nickel is given. A.

539.31 : 538.63 : 537.311.33

ELASTORESISTANCE IN SEMICONDUCTORS. See Abstr. 1275

539.32

1685. THE ELASTIC PROPERTIES OF HIGH TEMPERATURE β-QUARTZ. V.G.Zubov and M.M.Firsova.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 493-4 (1956). In Russian.

The adiabatic elastic constants C_{11}, C_{33}, C_{12} and C_{44} were measured between 578 and 630° C. The value of the last constant is virtually independent of the temperature and equal to 36×10^{10} dyn/cm^2 approx. The other constants increase with increasing temperature. The constant C_{12} changes sign at 584° C; the constants C_{12} and C_{33} have at this temperature relatively small positive values; at 600° all constants have values between 15 and 115×10^{10}. The authors check their results against published work; the agreement is satisfactory. R.Eisenschitz

539.32

1686. MEASUREMENT OF THE DYNAMIC MODULUS OF RUBBER FOR VERY SMALL DEFORMATION AMPLITUDES BY AN OPTICAL MODULATION-INTERFERENCE METHOD. N.M.Borovitskaya.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 5, 923-5 (1956). In Russian.

The mirror of a Michaelson interferometer was mounted on a rubber ring made from the specimen under investigation. An electrical condenser behind the mirror could be used to give the latter a mechanical vibration at about 300 to 500 c/s (below the natural resonance) with an amplitude down to 0.01 A. The interference fringes from the interferometer were projected on to the cathode of a photomultiplier. The Young's modulus of the specimen (of 2 mm thickness) was measured for amplitudes of 1 to 200 A and was found to be constant over this range to about 5%. The modulus depended on the shape of the specimen. A.L.Mackay

539.32

1687. THE ELASTIC AND THERMO-ELASTIC PROPERTIES OF COMPOSITE MEDIA. E.H.Kerner.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 808-13 (Aug., 1956).

It is shown how the gross bulk and shear moduli of a composite material consisting of a suspension of grains or a compact of grains may be deduced. The grains are assumed to be perfectly bonded to the suspending medium or to each other, and are taken to be spheres in the mean. By using an averaging procedure due to Bruggeman, and analysing the effect of a uniform hydrostatic compression and of a uniform tension on an average grain, a pair of de-coupled equations for the gross moduli is found for suspensions. When the suspending medium vanishes and the grains are packed, these equations become coupled and there is exhibited a discontinuity in the gross moduli. The bulk coefficients of linear expansion of the two kinds of composites are found from an analysis of the dilatation and bulk stress for average spherical grains when the composite as a whole is subjected to some small temperature change. All results are free of any limitation on the number of components. A.

539.32 : 539.434

1688. THE DETERMINATION OF DYNAMIC MODULI AND INTERNAL FRICTION OF HIGH POLYMERS FROM CREEP MEASUREMENTS. J.J.Benbow.
Proc. Phys. Soc. B, Vol. 69, Pt 9, 885-92 (Sept., 1956).

An account is given of the use of Fourier analysis to transform creep measurements to dynamic quantities with specific reference to some measurements made on polythene. The method is based on a technique described by Roesler, but additional theory is given which eliminates the necessity of determining the retardation spectrum explicitly. Using the derived dynamic quantities as a standard it is shown that more approximate methods provide sufficiently accurate transformations for many practical purposes if the retardation spectrum of the material is very flat. A.

539.374

1689. VISCOELASTIC PROPERTIES OF ICE. H.H.G.Jellinek and R.Brill.
J. appl. Phys., Vol. 27, No. 10, 1198-209 (Oct., 1956).

An apparatus has been constructed for the study of deformation under tension of single and polycrystalline ice. Deformations down to 10^{-5} cm could be measured. Deformation of single and polycrystals was investigated as a function of time, stress and temperature. Whereas the strain rate for polycrystalline ice decreases with time, that for single glacier ice increases linearly with time. The deformation for fine-grained polycrystalline ice consists of an instantaneous elastic deformation, a transient creep and a steady state creep. Deformation curves can be represented by empirical equations. The recovery curves on removal of the loads have also been investigated and the plastic flow has been deduced from the residual deformation after complete recovery. This plastic flow was found to be Newtonian within the range of stresses investigated and the viscosity coefficients can be represented by an exponential relationship

as follows: $\eta_1 = 7.5 \exp(+ 16\,100/RT)$ poises, where 16 100 calories is the energy of activation for the plastic flow. The total deformation can be represented satisfactorily by a large number of Voigt units representing a distribution of retardation times, in series with a Maxwell unit. The experimental results are further discussed in the light of current theories of dislocations and tentative mechanisms for the deformation of single and polycrystalline ice are proposed. A.

539.374 : 534.222.2

SHOCK WAVES IN A PLASTIC COMPRESSIBLE MEDIUM.
See Abstr. 1134

539.374.08

1690. DETERMINATION OF DYNAMIC PLASTIC STRAIN THROUGH THE USE OF DIFFRACTION GRATINGS. J.F.Bell.
J. appl. Phys., Vol. 27, No. 10, 1109-13 (Oct., 1956).

A new method is given for measuring dynamic plastic strain in metals under impact loading. Strain-time curves for initial and reflected wave fronts have been determined using a gauge length of $\frac{1}{32}$ in. The measurements are made by observing the behaviour during strain of the diffracted and central images of an 8300 line reflection grating ruled on the specimen surface. A.

539.4.019

1691. ROLE OF ELECTRICAL PHENOMENA IN THE MECHANISM OF RUPTURE OF CERTAIN SOLID BODIES. B.V.Deryagin, N.A.Krotova and V.V.Karasev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 728-30 (1956). In Russian.

In investigations on mechanical splitting of mica, special attention was paid to the work of splitting, A, as a function of velocity, v. The variation of A with v depends on external pressure. For a given v, as the pressure is decreased the work of splitting increases, passes through a maximum and then decreases. The work of splitting in argon is lower than in air. This is explained as the effect of argon on the magnitude of discharge potential at separation of an electric double layer. Luminescence is observed in the region of rapid splitting. These characteristics are absent in substances such as cardboard and rubber. Z.Krasucki

539.434

1692. RECENT ADVANCES IN KNOWLEDGE CONCERNING THE PROCESS OF CREEP IN METALS. A.H.Sully.
Progress in metal physics, Volume 6, 135-80. See Abstr. 7097 (1956).

A review. Discusses experimental work on the structural changes accompanying the first and second stages of creep, considering particularly the work of Wood, Crussard, McLean and Grant. The dislocation mechanism of primary and secondary creep is discussed qualitatively, and tertiary creep, leading to fracture, is considered. The variously proposed creep laws are discussed, and the practical consequences of creep described. 93 references. E.P.Wohlfarth

539.434

1693. CREEP OF TIN SINGLE CRYSTALS. J.Weertman and J.E.Breen.
J. appl. Phys., Vol. 27, No. 10, 1189-93 (Oct., 1956).

The activation energy of creep was determined for a series of tin single crystals oriented with the specimen axis close to a [110] direction. Two activation energies were found. A value of approximately 22 000 cal/mole was obtained for temperatures above 130°C; a value of about 11 000 cal/mole for temperatures below 130°C. A.

539.61

1694. LONDON–VAN DER WAALS ATTRACTIVE FORCES BETWEEN GLASS SURFACES. P.G.Howe, D.P.Benton and I.E.Puddington.
Canad. J. Chem., Vol. 33, No. 9, 1375-83 (Sept., 1955).

The attractive force between a Pyrex glass bead and plate has been measured using a sensitive pendulum-type apparatus. The force required for separation of the bead from the plate has been shown to be strongly time dependent, a phenomenon which appears not to have been reported previously for adhesions in gaseous media. The observed results have been shown to be consistent with the theoretical London – van der Waals interaction. The estimated value of the London force constant is compared with that obtained by other workers. A.

539.61

1695. PART PLAYED BY DIFFUSION IN THE PHENOMENA OF THE MUTUAL ADHESION OF HIGH POLYMERS. S.S.Voyutskiĭ, A.I.Shapovalova and A.P.Pisarenko.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 1000-3 (1955). In Russian.

Suggests a diffusion theory of adhesion of high polymers, according to which adhesion is related to mutual solution of high polymers. The theory is claimed to be corroborated by the fact that the adhesion increases as temperature rises and decreases when high polymers are subjected to vulcanization. F.Lachman

539.62

1696. INVESTIGATION OF THE MECHANISM OF MoS_2 LUBRICATION IN VACUUM. V.R.Johnson and G.W.Vaughn.
J. appl. Phys., Vol. 27, No. 10, 1172-9 (Oct., 1956).

In contrast to graphite, MoS_2 retains its lubrication properties in vacuum. The coefficient of friction of MoS_2 powder, compressed into pellets, has been measured under high vacuum conditions. Well run-in surfaces, which have been stationary for a period of time, show higher friction initially upon resumption of sliding. Presence of an amorphous layer of sulphur during sliding is postulated. A.

539.62

1697. ELASTIC DEFORMATION AND THE LAWS OF FRICTION. J.F.Archard.
Research Correspondence, Vol. 9, No. 7, S27-S28 (July, 1956).

On Bowden's theory, Amonton's law is true because plastic deformation occurs in regions of contact. Experiments on crossed Perspex cylinders and calculations on a model assuming a large number of points of contact, show that Amonton's law is also consistent with pure elastic deformation. J.W.Menter

539.63

1698. IMPACT PHENOMENA AT HIGH SPEEDS.
M.E.Van Valkenburg, W.G.Clay and J.H.Huth.
J. appl. Phys., Vol. 27, No. 10, 1123-9 (Oct., 1956).

A study of high speed, metal-to-metal impact in the velocity range 1 to 5 mm/μsec using $\frac{1}{8}$ in. diameter spherical pellets is described. Pellet materials include aluminium, magnesium, steel, brass, lead, and zinc. Experiments relating to the mechanisms of cratering and the perforation of thin targets are presented. For the $\frac{1}{8}$ in. diameter spherical pellets, it is found that the volume of the crater per unit energy of the impacting pellet is essentially constant for each material and that the penetration is proportional to the velocity of the pellet so long as the pellet velocity is less than the velocity of sound in the target material. An attempt to model very high speed impact by using soft wax targets in which the sonic velocity is less than the impacting velocity is outlined. A.

539.89

1699. SUBLIMATION OF A CRYSTAL LATTICE UNDER THE EFFECT OF A STRONG SHOCK WAVE. Yu.N.Ryabinin.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 289-91 (1956). In Russian.

Equation of state $v = 0.962\,[(p + 78\,000)/88\,000]^{1/3.6}$ has been derived by the author from NaCl compressibility data found in the papers of Bridgman (Proc. Amer. Acad. Arts Sci., Vol. 76, No. 1, 1, 1945) and Goranson and Johnson (Phys. Rev., Vol. 57, 845, 1940), and the relationship between the energy of isothermal compression and pressure has been calculated from this equation (the energy at 1 000 000 atm is about 3.5 eV/molecule, i.e. much higher than the heat of sublimation). Values of compression energy for the same volume change are much higher when the compression follows the Hugoniot adiabatic than when it is isothermal. A shock wave striking a body produces a compression along the Hugoniot adiabatic and a Poisson adiabatic expansion, the energy for the latter being greater still than for the former. Small NaCl specimens were compressed by shock waves obtained by detonating explosives, and pressures thus generated were calculated from equations of aerodynamics. A pressure of about 110 000 atm only compressed the salt; pressures of 200 000 to 260 000 atm yielded a greyish substance, the greyness being more intense after a pressure of 300 000 atm with subsequent rapid expansion. The crystal structure of the grey substance was identical with that of NaCl, but its aqueous solution had an alkaline reaction (possible partial decomposition $2NaCl = 2Na + Cl_2$). Still higher pressures (470 000 and 610 000 atm) with subsequent expansion caused distention or bursting of the glass ampoules, and a dark-grey substance was obtained. F.Lachman

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.11 : 536.37

COKING OF COAL BY ELECTRIC CURRENT. See Abstr. 1222

541.124

1700. KINETICS OF COMPETITIVE ISOTOPIC EXCHANGE REACTIONS. L.R.Darbee, F.E.Jenkins and G.M.Harris.
J. chem. Phys., Vol. 25, No. 3, 605 (Sept., 1956).

A mathematical solution of the rate equations of the simultaneous reactions $AX + CX^* \rightleftharpoons AX^* + CX$ and $BX + CX^* \rightleftharpoons BX^* + CX$ is given. W.Good

541.126

1701. THE PROBLEM OF A STRONG POINT-EXPLOSION IN A GAS WITH ZERO TEMPERATURE-GRADIENT. V.P.Korobeĭnikov.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 271-3 (1956). In Russian.

The adiabatic case has been covered by Sedov (Abstr. 2072/1947). Here there is extremely fast heat exchange and $\partial T/\partial r = 0$. The equations of motion of a perfect gas are set up and spherically symmetrical solutions are found giving the density and velocity. A.L.Mackay

541.126

1702. EXPERIMENTAL STUDY OF SPHERICAL GAS DETONATION. Ya.B.Zel'dovich, S.M.Kogarko and N.N.Simonov.
Zh. tekh. Fiz., Vol. 26, No. 8, 1744-68 (1956). In Russian.

The authors discuss the theoretical assumptions concerning the mechanism of a spherical gas detonation. Description is given of the determination of the efficiency of an electric spark and its dependence on energy, determination of the spark of energy equivalent to a lead azide system and the experiments with transitions of a detonation from a narrow tube into a wider space. About half the experiments were carried out with $C_2H_2 + 2.5\ O_2$ mixtures plus amounts of nitrogen varying from zero to $1.25\ N_2$. There are 21 photographs. The experiments which are in qualitative agreement with theory, show that it is possible to initiate a spherical gas detonation by means of a plane shock wave which is changing into a spherical one on passing from a tube into an open space, and in this case it is shown that the diameter must not be less than a certain critical size. C.R.S.Manders

541.127

1703. ON FLAME PROPAGATION IN EXPLOSIVE MIXTURES OF GASES. I. GENERAL THEORY. R.Sandri.
Canad. J. Chem., Vol. 34, No. 3, 313-23 (March, 1956).

The system of differential equations of flame propagation is set up and discussed. It is shown that, without any major influences being neglected, the energy equation can be reduced to the form $\xi(d\xi/d\eta + 1) = \phi(\eta)$ with the boundary conditions $\xi = 0$ for $\eta = 0$ and for $\eta = 1$. Some qualities of the solutions of this equation are discussed and a simple numerical method of solution is described. The flame velocity V_0 is found as an eigenvalue of the energy equation. The temperature distribution in the flame zone can then be found by an ordinary quadrature. Further, an approximation formula for finding V_0 directly is derived

$$V_0 = \frac{1}{1 - \eta_m}\left[2\int_{\eta}^{1} F(\eta)d\eta\right]^{1/2}$$

where $F(\eta)$ is proportional to $\phi(\eta)$ and has a maximum for $\eta = \eta_m$. A.

541.127

1704. ON FLAME PROPAGATION IN EXPLOSIVE MIXTURES OF GASES. II. ON THE DECOMPOSITION FLAME OF OZONE. R.Sandri.
Canad. J. Chem., Vol. 34, No. 3, 324-30 (March, 1956).

The general theory developed in Pt I is applied to the ozone explosion. Values of the linear flame velocity are computed under the assumption of constant enthalpy and, without this assumption, for different values of the reduced diffusion coefficient. The results do not differ very much and are found to be in very good agreement with experiments. They are further compared to the results which were obtained by Hirschfelder et al. by exact numerical integration and by Kármán and Penner by an approximation method and are found to be between the values obtained by these authors. A.

541.127

1705. ON FLAME PROPAGATION IN EXPLOSIVE MIXTURES OF GASES. III. FLAME PROPAGATION IN MIXTURES OF METHANE AND NITROGEN AIR, HELIUM AIR, AND ARGON AIR. R.Sandri.
Canad. J. Chem., Vol. 34, No. 3, 331-7 (March, 1956).

The general theory developed in Pt I is applied to the combustion of mixtures of methane and nitrogen air, helium air, and argon air where dissociation of the end products is negligible. The oxygen atom chain is assumed to be rate-determining. Absolute values of the flame velocity are computed for mixtures containing 8% of methane and for the stoichiometric mixtures. The results are found to be in very good agreement with experimental values. Dependence on pressure is likewise found to be in very good agreement with experiments. The temperature distribution in the flame zone is also computed. A.

541.128 : 532.517.2

1706. ON CHEMICAL SURFACE REACTIONS IN LAMINAR BOUNDARY LAYER FLOWS. P.L.Chambré and A.Acrivos.
J. appl. Phys., Vol. 27, No. 11, 1322-8 (Nov., 1956).

The progress of an isothermal chemical reaction on a catalytic surface, which is located in a laminar hydrodynamic flow field of large Reynolds number, is analysed. Past analytical investigations have been restricted primarily to chemical reactions in fully velocity developed flow fields subject frequently to one or both of the following approximations. (i) The actual velocity distribution is replaced by a flow of uniform velocity. (ii) The concentrations of the reactants on the catalytic surface are prescribed subject to certain hypotheses concerning the rate controlling mechanism. In this investigation the principal aim has been to calculate the actual surface concentration in a laminar boundary layer flow without unduly sacrificing the hydrodynamic features or introducing unnecessary assumptions about the effective over-all reaction mechanism. The method presented, which is related to an analysis of convective heat transfer from a nonisothermal surface, is applicable to arbitrary catalytic reaction mechanisms in a certain class of laminar boundary layer type flow fields. A.

ELECTROCHEMISTRY 541.13

541.133

1707. THE LINEARITY OF ELECTROLYTIC IMPEDANCES. G.S.Buchanan and F.Gutmann.
C.R. Acad. Sci. (Paris), Vol. 243, No. 4, 374-8 (July 23, 1956). In French.

The authors confirm earlier findings that the conductivity of an electrolyte measured in a field of a definite frequency is not affected by the presence of a field of different frequency. They indicate that the explanation lies in the overvoltage at the electrode double layers, describing experimental results to confirm their opinion, and they show that the total admittance of the calomel cell used is virtually independent of a frequency of more than 500 c/s and the system then behaves as a pure ohmic resistance. W.A.Walker

541.133

1708. THE ELECTRICAL CONDUCTIVITY OF CONCENTRATED AQUEOUS ELECTROLYTIC SOLUTIONS. P.J.Gellings.
Recueil Trav. chim. Pays-Bas, Vol. 75, No. 3, 209-19 (March, 1956).

A semi-empirical equation for the conductivity of concen-

trated electrolytic solutions is derived from the Debye–Hückel–Onsager limiting law. The comparison of this equation with experiment shows agreement within a few per cent or better, up to 4 to 5 N and in one case even up to 11 N. Measurements on $NaNO_3$ up to 4.85 N and $K_3Fe(CN)_6$ up to 2.96 N are reported. Details of the null-point detector and the variable-frequency oscillator used in the bridge circuit are also given. A.

541.135.5

1709. HYDROGEN OVERVOLTAGE ON BRIGHT IRIDIUM AND RHODIUM. J.P.Hoare and S.Schuldiner.
J. chem. Phys., Vol. 25, No. 4, 786 (Oct., 1956).

The Tafel "b" slope for the overvoltage v. log current density curves indicate that on both these metals the rate-controlling step for the hydrogen producing mechanism is the slow discharge of hydronium ions in the double layer but on the cathodically polarized metals is quite different from that on either platinum, gold or palladium. W.Good

PHOTOCHEMISTRY. RADIATION CHEMISTRY 541.14/.15

541.15

1710. MECHANISM IN THE RADIOLYSIS OF AQUEOUS GLYCINE SOLUTIONS. II. W.M.Garrison and B.M.Weeks.
J. chem. Phys., Vol. 25, No. 3, 585 (Sept., 1956).

For previous part see Abstract 5479 (1956). The experimental data suggest that the principle locus of decomposition involves the N–C bond and that the formation of NH_2 and CH_2COOH in evacuated solutions occurs through predissociation of an excited glycine molecule. W.Good

541.15

1711. RADIOLYSIS OF CARBON TETRACHLORIDE–ALCOHOL MIXTURES. K.Hannerz.
Research Correspondence, Vol. 9, No. 1, S1-S3 (Jan., 1956).

Carbon tetrachloride was mixed with one of 14 different alcohols. The mixtures were irradiated and the production of HCl measured. It was found that mixtures with primary alcohols were more radiosensitive than the others. G values ranging from 17 to 1810 were measured. Chain reactions with dehydrogenation of the alcohols were operative and the results were not as reproducible as would be required for dosimetric purposes. When irradiation was carried out in the presence of oxygen, hydroperoxide formation was observed. Some kinetic aspects of the reactions are discussed. M.Ebert

DISPERSIONS. COLLOIDS. ADSORPTION 541.18

541.183.3

1712. ADSORPTION AT INTERFACES BETWEEN LIQUID PHASES. I. THERMODYNAMICS. H.D.Ohlenbusch.
Z. Elektrochem., Vol. 60, No. 6, 603-6 (1956). In German.

Following Guggenheim the transition zone between two phases is treated as a separate boundary phase and the chemical potential of the components derived by a unique variation of the boundary phase. Both the Szyszkowsky equation and the corresponding adsorption isotherm can then be derived, and under suitable conditions they lead to the Langmuir isotherm. The gegenions do not constitute part of the boundary phase as defined above, but the electrostatic energy constant of the double layer must be taken into account in calculating the free interfacial energy. S.J.Gregg

541.183.3

1713. ADSORPTION AT INTERFACES BETWEEN LIQUID PHASES. II. ADSORPTION OF ELECTROLYTES AND STRUCTURE OF THE ELECTRICAL DOUBLE LAYER. H.D.Ohlenbusch.
Z. Elektrochem., Vol. 60, No. 6, 607-16 (1956). In German.

From a consideration of the phase boundary potentials of oil–water interfaces it is established that in the adsorption of ionized particles almost the whole of the double layer is in the aqueous phase. The structure of the double layer is discussed by reference to ionic volume and the potential is determined as a function of the surface charge. The lowering of the interfacial tension consequent on adsorption of electrolytes is thereby described. The free interfacial energy contains an osmotic term represented in the Szyszkowsky equation and also an electrostatic term which gives the energy content of the whole electrical double layer. The acquisition of a charge by the layer through ion adsorption leads to a reduction of the surface activity, i.e. to a displacement of the dissociation equilibrium of the electrolyte in the interface. The consequences of the theoretical treatment are compared with recorded experimental results. S.J.Gregg

CHEMICAL STRUCTURE 541.2/.6

541.48 : 539.172.4

1714. THE CHEMISTRY OF RUTHENIUM. J.M.Fletcher and F.S.Martin.
Atomic Energy Res. Establ. (Harwell) Mem. No. C/M 256, 6 pp. (1955).

Both in the processing of reactor fuels and in any subsequent disposal or treatment of gross fission products, it is not unusual to find that ruthenium behaves in an exceptional manner. Thus whereas other fission products can usually be persuaded to follow one definite course in a chemical treatment, fission product ruthenium is apt to follow several courses. The isolation and properties of some of the co-ordination complexes of nitrosylruthenium, formed in nitric and nitrous acids, are described in relation to the fate of fission-product ruthenium, and to the chemistry of other forms of ruthenium and of other metals. A.

541.61

1715. ON THE DOUBLE-MAXIMA DISTRIBUTION OF DEUTERO-PARAFFINS. T.Keii.
J. chem. Phys., Vol. 25, No. 2, 364 (Aug., 1956).

In a study of the catalytic deuteration of propylene a new type of distribution of deutero-paraffins has been observed, involving two maxima. (Bond and Turkevich, Trans. Faraday Soc., Vol. 49, 381, 1953). This is discussed here in terms of a reaction mechanism, illustrated by the deuteration of ethylene, which accounts for the two maxima. These could not be explained by a random distribution, which gives only one maximum. C.E.King

541.64 : 537.226.2

1716. A DIELECTRIC STUDY OF PLASTICIZED POLYVINYLIDENE CHLORIDE. B.L.Funt and T.H.Sutherland.
Canad. J. Chem., Vol. 33, No. 11, 1669-76 (Nov., 1955).

The electrical response of plasticized polyvinylidene chloride has been studied over a wide range of frequency, temperature, and plasticizer content. The dispersion region was shifted to lower temperatures at a given frequency on the addition of alpha chloronaphthalene as plasticizer, but remained practically unchanged with hexachlorobenzene as plasticizer. Comparison was made with mechanical measurements for plasticized vinylidene chloride copolymers and reasonable agreement between electrical and mechanical properties was found. Enthalpies and entropies for dielectric relaxation were calculated on the theory of absolute reaction rates and were compared with values for plasticized polyvinyl chloride. A calculation of plasticizer efficiency from electrical measurements was attempted on the basis of a method suggested by Dyson. An interesting empirical relationship between enthalpy and entropy of activation and plasticizer content in polyvinyl chloride and polyvinylidene chloride is presented. A.

541.67 : 538.222

1717. A NEW EFFECT OF OXYGEN ON THE PARAMAGNETIC RESONANCE OF CHARCOALS. J.Uebersfeld and E.Erb.
C.R. Acad. Sci. (Paris), Vol. 243, No. 4, 363-5 (July 23, 1956). In French.

For sugars carbonized below 600°C the intensity of electron resonance shows a maximum against partial pressure of O_2. This indicates that O_2 is able to create free radicals as well as destroy them again when present in excess; both processes are reversible. D.H.Whiffen

541.67

1718. STRUCTURE AND MAGNETIC PROPERTIES OF Co_3O_4 AND $ZnCo_2O_4$. P.Cossee.
Recueil Trav. chim. Pays-Bas, Vol. 75, No. 8, 1089-96 (Aug., 1956).

Measurements are described of the paramagnetic susceptibilities of Co_3O_4, $ZnCo_2O_4$, and mixed crystals of $ZnAl_2$—$ZnCo_2O$ and the results are given in a table of χ-values and two plots of $1/\chi$ against absolute temperature. To explain the very low value of the mean Bohr magneton number, found for these compounds, the assumption is made that Co^{3+} in these spinel structures is situated at octahedral interstices and covalently bonded as in the other complex compounds of Co III, thus not contributing to the paramagnetism. This assumption gives the reasonable, although somewhat high value of $4.7\,\mu_B$ for the Co^{2+} ion in Co_3O_4. This high value of μ for Co^{2+} and the weak paramagnetism of $ZnCo_2O_4$ may be caused by a slight oxygen deficiency of the compounds or a small energy difference between the diamagnetic and paramagnetic states of Co^{3+} in octahedra. A.

CHEMICAL ANALYSIS 543/545

545 : 539.172.4

1719. ANALYTICAL METHODS FOR FISSION PRODUCT TIN AND ANTIMONY. G.B.Cook.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 424, 5 pp. (1955).

Two methods for the estimation of tin activities in fission product mixtures are discussed and one of them is used to determine the fission yields of 28 hr Sn^{121} and 10 day $Sn^{(123)}$. Values of 1.10×10^{-2} and 1.25×10^{-2} % were obtained for the former and 1.19×10^{-2} and 1.16×10^{-2}% for the latter. The value for $Sn^{(123)}$ is considerably higher than the previous figure. For the estimation of antimony, the electrolytic formation of stibine is recommended which readily gives chemical yields of greater than 60%. A.

545.1

1720. THE ANALYSIS OF URANIUM—NIOBIUM ALLOYS. G.W.C.Milner.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 852, 15 pp. (1956).

A satisfactory procedure is described for the analysis of uranium—niobium alloys containing up to 25% niobium. It is based on the separation of the niobium from uranium by dissolving the cupferron complex of the former element into chloroform. After the evaporation of the solvent from the combined organic extracts, the niobium is ignited to the pentoxide. The uranium is afterwards precipitated from the remaining aqueous solution by the addition of ammonium hydroxide after the wet oxidation of organic matter. Absorptiometric procedures are included for the determination of the small amounts of uranium co-extracted with the niobium and the trace amounts of unextracted niobium. A.

545.822

1721. A CONTRIBUTION TO THE APPLICATION OF FLAME PHOTOMETRY ON Ca, Sr, Ba AND Li. T.Hollander, A.J.Borgers and C.T.J.Alkemade.
Appl. sci. Res. B, Vol. 5, No. 6, 409-27 (1956).

Test solutions containing Li, Ca, Sr and Ba salts were sprayed into a flame photometer of simple design. The line-to-background ratio, the detection limit, interference effects, filter leakage and the form of the standard graphs were investigated. With each element readings were made with a series of interference filters of varying central wavelength and with an acetylene-air and propane-air flame, for comparison. From the results obtained conclusions can be drawn concerning the optimum measuring conditions to be used in routine analysis. Also an approach is made to the quantitative understanding of the form of the standard graphs with Ca, Sr and Ba, in the lower concentration range, based on the underlying ionization and dissociation processes. A characteristic saturation effect of the photomultiplier tube used is reported. A.

545.822

1722. THE DETERMINATION OF URANIUM BY HIGH-PRECISION SPECTROPHOTOMETRY. A.Bacon and G.W.C.Milner.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1637, 23 pp. (1955).

A procedure is described for determining the uranium content of relatively pure samples of U_3O_8 and uranium metal with a precision (1σ) of ± 0.04%. The sample is dissolved in nitric acid and this solution is then converted to standard conditions of acidity by evaporating to fumes of sulphuric acid. After dilution with water to a standard volume, the absorbency of the sample solution is measured at 430 mμ, using a reference solution of accurately known uranium content. The uranium content of the sample is then obtained either by referring the absorbency difference to a calibration graph or by calculation using a factor derived from the calibration graph. The main factors which influence the accuracy of the determination are discussed in detail. A.

545.822

1723. FIRST ANALYTICAL APPLICATION OF THE "EFFECTIVE LINE WIDTHS". R.Intonti.
R.C. Ist. Super Sanità, Vol. 19, Pt VI, 449-60 (1956). In Italian.

The results of a series of preliminary experiments are given in order to show how far the "effective widths" of spectral lines are suited for the determination of intensities and concentrations. The intensities were varied according to the inverse square law, putting a constant pointlike light-source (mercury lamp) on the optical bench in front of the spectrograph, and varying the distances which could be read on a scale on the bench. The variation in intensity of a Hg line was first directly measured with the "Lichtelektrometer". Then the photographs were taken, the conditions remaining strictly unchanged. Plotting effective width against log intensity straight lines are obtained from density one to higher densities, even when these were no longer measurable by ordinary methods. For the application of the method to analysis, a series of Al-standard electrodes with known contents of Si and Mg were used. The analytical curves, effective width against log concentration, also proved rectilinear. A.

545.844 : 539.16.08

1724. THE DETERMINATION OF RADIOACTIVITY DUE TO FISSION PRODUCT NIOBIUM. A.J.Fudge.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1502, 9 pp. (1955).

A method is described for the separation of fission product niobium by the use of a paper chromatographic procedure. Carrier niobium is added to a fluoride solution of the fission products and development of the chromatogram is carried out with 20% hydrofluoric acid/methyl ethyl ketone. The niobium area on the paper (after visual detection with tannin) is counted using a γ-scintillation counter against Nb^{95} standards. Up to twenty samples can be analysed simultaneously, the overall time for the method being about two and a half hours. The results of parallel analyses carried out by this procedure and by the D.At.En.Method 1013 are in agreement to within 3%. The coefficient of variation of the results obtained by the chromatographic method was 3% for fission product solutions and 2% for standard niobium solutions. A.

CRYSTALLOGRAPHY 548

548.2

1725. MOSAIC STRUCTURE. P.B.Hirsch.
Progress in metal physics, Volume 6, 236-339. See Abstr. 7097 (1956).

A review. The pre-dislocation ideas are outlined. The distribution of dislocations in annealed crystals is discussed, using evidence from growth spirals, etched crystals, cleavages, direct observation and X-ray diffraction studies. The effect of deformation on the distribution of dislocations is discussed; both the effects of rapid deformation at low temperatures and of slow deformation at high temperatures are described. 369 references. E.P.Wohlfarth

548.2

1726. PROPAGATION OF CLEAVAGE CRACKS IN CRYSTALS. J.J.Gilman.
J. appl. Phys., Vol. 27, No. 11, 1262-9 (Nov., 1956).

The role of crack propagation velocity in the cleavage of crystals and aggregates is emphasized. The available data on crack propagation in elastic media are summarized, showing that this phenomenon is adequately understood at present. For inelastic media, it is postulated that in addition to the Griffith criterion two critical velocity conditions must be satisfied or crack propagation cannot occur. One critical velocity pertains to propagation through a crystal, and the other to propagation through an aggregate. The first critical velocity depends on the rate at which plastic glide can absorb energy at a crack tip and the number and size of cleavage steps that a crack front contains. These quantities are estimated. The second critical velocity accounts for the dependence of fracture stress on grain size in aggregates and interprets other experimental behaviours of aggregates which contradict previous interpretations. A.

548.5

1727. THE FILAMENTARY GROWTH OF METALS. H.K.Hardy.
Progress in metal physics, Volume 6, 45-73. See Abstr. 7097 (1956).

A review, discussing filamentary growth of metals on minerals, sulphides, halides and metals. The crystal structure and electrochemical characteristics of filaments are discussed. The mechanisms of the growth are considered, particularly the dislocation mechanism for the growth of metals on metals. 108 references. E.P.Wohlfarth

548.5 : 621.318.12

1728. A NOTE ON CRYSTAL FORMATION IN THE METALLIC OXIDES. L.R.Maxwell and S.J.Pickart.
Proc. Instn Elect. Engrs, Paper 2190 R, publ. Oct., 1956, 2 pp. To be republished in Vol. 104 B (1957).

Describes the behaviour of $N\frac{3}{2} + O_3$ when heated to the usual sintering temperatures with $M^{2+}O$ in the following combinations: $N^{3+} = B^{3+}$, $M^{2+} = Ni^{2+}$; $N^{3+} = Fe^{3+}$, $M^{2+} = Sr^{2+}$ and Ba^{2+}; $N^{3+} = In^{3+}$, $M^{2+} = Co^{2+}$, Zn^{2+}, Ca^{2+}, and Ba^{2+}; $N^{3+} = Y^{3+}$, $M^{2+} = Cu^{2+}$, Zn^{2+}, Mn^{2+}, Cd^{2+}, Sr^{2+}, and Ba^{2+}; $N^{3+} = Gd^{3+}$, $M^{2+} = Ni^{2+}$, Ca^{2+}, Sr^{2+}, and Ba^{2+}; and $N^{3+} = La^{3+}$, $M^{2+} = Cu^{2+}$, Zn^{2+}, Mn^{2+}, Cd^{2+}, Sr^{2+}, and Ba^{2+}. In many instances the components would not react leaving unmixed phases; when reaction did occur no cubic spinels were formed. The relative size of the trivalent and divalent ion is apparently important for the formation of solid solutions. A double trivalent substitution of both Sc^{3+} and Al^{3+} for Fe^{3+} in nickel ferrite did not yield a compensation point. The relation to ferrite applications is included. A.

548.5 : 537.311.33

EFFECTS OF GROWTH RATE ON CRYSTAL PERFECTION IN GERMANIUM. See Abstr. 1284

548.52

1729. THE ADVANCE OF MONO-MOLECULAR STEPS ON THE SURFACE OF A GROWING KOSSEL CRYSTAL AS A RANDOM WALK PROBLEM. R.Gevers.
Physica, Vol. 22, No. 9, 832-42 (Sept., 1956).

The problem of the advance of a monomolecular step on a low-index face of a growing Kossel crystal is considered as one of the random-walk type, i.e. the movement of the particles results from discontinuous jumps on the surface and along the edge of the step. If the supersaturation and the jump probabilities, which depend strongly on the temperature, are given, an expression for the lateral growth velocity of the step can be calculated. The result can be brought into the form $v = v_\infty A_0$, where v_∞ is the velocity of a total absorbing step, while A_0 is a factor, which is only a function of the jump probabilities and the mean distance between kink-places, and not of the supersaturation, and which has a value between 0 and 1. A stationary regime is supposed to be created by taking away the particles, which arrive at the kink-places and by bringing these again into the vapour phase. The equations, which state that at every site on the surface or at the edge of the step, the number of arriving particles equals that of the leaving ones, are the basic ones. These enable the calculation of the rate of advance v of the step. In certain cases the formula for v can be approximated and the results can be compared with those obtained by Burton, Cabrera and Frank, who have treated the same problem as a continuous diffusion problem. A.

548.55

1730. VAPOR PHASE CRYSTALLIZATION OF CADMIUM SULFIDE CRYSTALS. J.M.Stanley.
J. chem. Phys., Vol. 24, No. 6, 1279-80 (June, 1956).

Single CdS crystals were prepared by heating CdS in fused quartz, Vycor and ceramic tubes in a N or A atmosphere to 900-1040°C for 16-48 hours. Plates of 22 x 25 x 1 mm^3 and prisms of 28 x 3 x 3 mm^3 were obtained. The absorption edge occurs at 525 mμ. The crystals have piezoelectric properties. CdSe crystals up to 28 x 14 x 0.8 mm^3 were grown by a similar method. J.Franks

ATOMIC AND X-RAY CRYSTALLOGRAPHY

548.7

548.7

1731. DISTRIBUTION OF VIBRATIONAL FREQUENCIES OF A CRYSTAL BY FOURIER TRANSFORMATION OF THE HEAT CAPACITY. W.J.Taylor.
J. chem. Phys., Vol. 25, No. 4, 721-3 (Oct., 1956).

It is shown that when represented on a logarithmic temperature scale a thermodynamic function is the resultant or convolution of the frequency distribution function and a function characteristic of a single oscillator. The inversion to yield the frequency distribution function may be accomplished by means of a theorem on the Fourier transform of a resultant. The method is related to that of Montroll, but may be in a more practical form for calculation. The present formulation also yields a quantitative expression for the error in the frequency distribution function which shows the importance of adequate smoothing of the experimental data. A.

548.7

1732. LOW-TEMPERATURE BEHAVIOR AND DISPERSION RELATIONS OF FACE-CENTERED CUBIC METALS. G.K.Horton and H.Schiff.
Phys. Rev., Vol. 104, No. 1, 32-6 (Oct. 1, 1956).

The temperature variation of the effective Debye temperature Θ near the absolute zero is investigated for some face-centred cubic metals on the basis of: (a) the Born and Begbie noncentral force theory taking nearest neighbour interactions only into account; (b) the customary central force model, used by Fine, Leighton, etc. The results are found to be qualitatively similar to those recently obtained by Bhatia and Horton on the basis of a model for monovalent metals proposed by Bhatia. The present results are based throughout on Houston's approximation to the frequency spectrum. The dispersion relations for Cu are calculated along the (100), (110) and (111) directions on the basis of (a), with nearest and next-nearest neighbour interactions; on the basis of (b); and from the equations of Bhatia and Horton. The results are compared with recent experimental results obtained from temperature-diffuse X-ray scattering by Jacobsen. It is found that, with a choice of force constants consistent with the observed elastic constants, all three theories agree with the experimental results to about the same extent. A.

548.7

1733. HOUSTON'S METHOD AND ITS APPLICATION TO THE CALCULATION OF CHARACTERISTIC TEMPERATURES OF CUBIC CRYSTALS. D.D.Betts, A.B.Bhatia and M.Wyman.
Phys. Rev., Vol. 104, No. 1, 37-42 (Oct. 1, 1956).

Houston's formula first derived for an approximate determination of the frequency spectrum of cubic crystals, essentially approximates the integral over the surface of a unit sphere of any function $I(\theta, \varphi)$ which is invariant under the operations of the cubic symmetry group in terms of the values of $I(\theta, \varphi)$ along the three directions (100), (110) and (111). In this paper approximate formulae are given for the integral in terms of the values of $I(\theta, \varphi)$ along the above three and any or all of the (210), (211) and (221) directions. As an application, Debye temperatures Θ are calculated for nine cubic crystals. It appears that the Θ-values calculated from the formula containing the values of I along all the above six directions may be expected to be correct to about 1% for crystals for which $0.25 < \eta < 4.0$ [where $\eta \equiv 2c_{44}/(c_{11}-c_{12})$]. For the alkali metals ($\eta \sim 8$), the error can be as large as 10%. Houston's method involves the expansion of $I(\theta, \varphi)$ in terms of those Kubic harmonics which are invariant under all the operations of the cubic symmetry group. In the Appendix, formulae are derived from which the Kubic harmonics of this type of any degree may be written down readily. A.

548.7

1734. DEBYE CHARACTERISTIC TEMPERATURES OF CERTAIN NONCUBIC CRYSTALS. D.D.Betts, A.B.Bhatia and G.K.Horton.
Phys. Rev., Vol. 104, No. 1, 43-7 (Oct. 1, 1956).

The Debye characteristic temperatures of noncubic crystals with a principal axis of symmetry are evaluated by an expansion of the integrand involved in terms of harmonic polynomials having the same symmetry as the corresponding Christoffel equation of elasticity theory. The method has been applied to representative hexagonal, tetragonal and trigonal crystals and the question of its convergence examined. The absolute values of the characteristic temperatures obtained here are unreliable because of a lack of 0°K elastic constants for the crystals concerned. A.

548.7 : 539.219

1735. THE EFFECT OF ORDERING ON THE ENERGY SPECTRUM OF PHONONS. I.M.Lifshits and G.I.Stepanova.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 156-7 (1956). In Russian.

The method of Abstr. 7814/1956 was used to determine the spectral density of solid solutions of two isotopes with a small mass difference for various degrees of lattice ordering. J.B.Arthur

548.7

1736. ON THE DEFORMATION OF THE ELECTRON DISTRIBUTION OF IONS IN SOME ALKALI HALIDE CRYSTALS. U.Korhonen.
Ann. Acad. Sci. Fennicae AI, Paper 221, 19 pp. (1956).

The atomic scattering factors of the ions belonging to the NaF, NaCl, KCl, RbCl, KBr and KI crystals and to the KCl–KBr and RbCl–KCl solid solutions measured experimentally by Wasastjerna (1946) have been calculated separately in each crystal for the reflections 100, 200, 300, 400, 500, 600, 700, 111, 222, 333, 444, 110, 220, 330, 440, and 550 by using a method developed by the writer (Abstr. 1753, 1957). The results obtained show many interesting phenomena, above all that the ions and atoms belonging to these crystals have deformations in their electron clouds due to the neighbouring atoms. The calculations and considerations carried out in this paper have proved that by using X-ray intensity measurements and the method developed by the writer for calculating the atomic scattering factors from measured structure factors it is possible to study accurately the electron cloud deformations and simultaneously also the other phenomena presented in this paper. A.

548.7 : 537.311.33

1737. DISTRIBUTION OF ELECTRON DENSITY IN THE CdS CRYSTAL AS A FUNCTION OF CHANGES IN ITS ELECTRICAL CONDUCTIVITY. Yu.N.Shuvalov.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 4, 753-6 (1956). In Russian.

The Weisenberg technique was used to study the electron density distribution as a function of resistivity over a range of 110×10^6 ohm cm to 2.5×10^3 ohm cm. Distribution maps show that as the resistivity decreases, electron bridges are formed between neighbouring atoms in the (001) plane, in the directions of the chemical bonds of the lattice. The variations in distribution on illumination and heating were examined for specimens of various photosensitivities, the magnitude of the change increasing with photosensitivity. J.B.Arthur

548.7 : 537.311.33

1738. THE CONNECTION BETWEEN CHANGES IN ELECTRICAL CONDUCTIVITY AND DISTRIBUTION OF ELECTRON DENSITY IN THE CdS CRYSTAL. Yu.N.Shuvalov.
Zh. tekh. Fiz., Vol. 26, No. 9, 1870-9 (1956). In Russian.

A fuller account of the work described in an earlier paper (see preceding abstract). J.B.Arthur

548.7

1739. SELF-ENERGY OF ELECTRONS IN LATTICE FIELDS. M.Gurari.
Rep. Brit. Elect. Res. Assoc., Rep. L/T284, 4 pp. (1952).

A new method is developed to calculate the self-energy of an electron in a field such as the polarization field of an ionic lattice. With the help of the variational method, it is shown that the energy calculated from perturbation theory always gives an upper limit to the lowest energy level, however strong the interaction. Application to electrons in ionic crystals gives a lower (better) value for this energy than was found in previous theories. The effective mass of the electron is about twice the electronic mass. A.

548.7

1740. ELECTRONS IN POLAR MATERIALS. M.J.Buckingham.
Rep. Brit. Elect. Res. Assoc. Rep. L/T312, 7 pp. (1954).

A variation method is used to calculate the ground-state energy of an electron in an ionic crystal. Contrary to the case for weaker interaction, it is shown that the lowest state is one in which the electron density is localized if the interaction with the lattice is stronger than a critical value. The method is not suitable for the discussion of higher energy states when the interaction is strong. A.

548.7

1741. "SMOOTHING" OF THE CHARGE DENSITY IN THE THEORY OF POLARONS. M.Sh.Giterman.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 991-2 (1956). In Russian.

In the theory of polarons, as developed by Pekar, the polarization potential is calculated from a "smoothing" wave-function. The error introduced by this "smoothing" is estimated by the author for the case when the polarization radius, r, exceeds the distance, a, between adjacent ions, as is the case in the alkali halides. In particular, for NaCl the error in the energy is 10-12% and is negative. This result, together with that of Tolpygo (Abstr. 1317/1942) who found that Pekar's method overestimated the energy by about 12-13%, confirms the validity of Pekar's approximation, even when r exceeds a by 2-3 times. J.B.Arthur

548.7 : 538.222

1742. PARAMAGNETIC RESONANCE ABSORPTION IN Mn^{++} C.MacLean and G.J.W.Kor.
Appl. sci. Res. B, Vol. 4, No. 6, 425-33 (1955).

Paramagnetic resonance absorption at room temperature in 25 divalent manganous salts is reported. From the shapes of the resonance curves information is obtained with regard to exchange and dipole–dipole interactions. A.

548.7

1743. PARAMAGNETIC RESONANCE OF MANGANESE IN SINGLE CRYSTALS OF ALKALI HALIDES. P.A.Forrester and E.E.Schneider.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 833-7 (Aug., 1956).

Differences in the spectrum of Mn in NaCl and KCl crystals grown from the melt and KCl, KBr and KI crystals grown from solution are reported. These are discussed in relation to the Mn-habitat in the monovalent host lattice. J.E.Caffyn

548.7

1744. PARAMAGNETIC RESONANCE SPECTRUM OF MANGANESE IN SINGLE CRYSTALS OF ALKALI HALIDES GROWN FROM SOLUTION. W.Low.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 837-8 (Aug., 1956).

Differences in the spectrum for NaCl and KBr are reported and reasons for the different g factors are suggested. J.E.Caffyn

548.7 : 539.213.1

1745. THE SYSTEMATICS OF IMPERFECTIONS IN SILICON–OXYGEN NETWORKS. J.M.Stevels and A.Kats.
Philips Res. Rep., Vol. 11, No. 2, 103-14 (April, 1956).

The structure of the SiO_2 network permits a wide variety of possible imperfections, a number of which are discussed. A system is developed by which these imperfections may be described, after which the system is extended so as to allow of the description of the structure of glasses. Besides this "synthetic" system for the nomenclature of the centres, an "analytical" system is developed. The advantages of both systems are discussed. A.

548.7 : 534.2

1746. SUPERSONIC DISLOCATIONS AND DISLOCATIONS IN DISPERSIVE MEDIA. J.D.Eshelby.
Proc. Phys. Soc. B, Vol. 69, Pt 10, 1013-19 (Oct., 1956).

The conditions governing the motion of a screw dislocation at velocities above and below the velocity of shear waves are contrasted. For supersonic motion the Peierls–Nabarro equation becomes a differential equation, in contrast to the subsonic integral equation. It has a solution representing a moving restoration of fit along a slip plane across which there was originally complete misfit. In a dispersive medium where the sound velocity decreases with decreasing wavelength a dislocation moving between the maximum and minimum sound velocities suffers a retarding force, which may be calculated if the shape of the dislocation is supposed to be known. A.

548.7 : 535.37

COLOUR CENTRES AND FOREIGN IONS IN CERTAIN FLUORIDES. See Abstr. 1194

548.7 : 539.11

LATTICE ENERGY AND CONSTANTS OF Ag. See Abstr. 1472.

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.732

1747. ANOMALOUS ATTENUATION OF X-RAYS IN THE CASE OF BRAGG REFLECTION. H.Wagner.
Z. Phys., Vol. 146, No. 2, 127-68 (1956). In German.

A plane parallel-sided plate of ideal crystal is considered. Instead of considering an infinitely wide X-ray beam falling on an infinitely wide crystal, a beam of finite width is considered. The variation of absorption coefficient for angles of incidence near the total reflection region is calculated, and the distribution of energy inside the crystal is investigated. A.R.Stokes

548.733

1748. A LOW-TEMPERATURE APPARATUS FOR SINGLE-CRYSTAL X-RAY GONIOMETERS. T.T.Harding.
Canad. J. Phys., Vol. 34, No. 3, 371-5 (March, 1956).

An apparatus is described which may be used to grow and maintain single crystals at temperatures down to approximately -180°C. The crystals may be grown directly upon the head of the X-ray goniometer in order to permit the recording of data required for the investigation of the crystalline structure of substances which exist in the liquid or gaseous states at ordinary temperatures. A.

548.733

1749. A NEW METHOD OF X-RAY DIFFRACTION EXAMINATION OF RADIOACTIVE MATERIALS. S.T.Konobeevskiĭ, B.M.Levitskiĭ and Yu.A.Martynyuk.
Zh. tekh. Fiz., Vol. 26, No. 4, 870-3 (1956). In Russian.

The diffracted beam in a "Norelco" diffractometer is monochromatized and deflected by a curved rock-salt crystal set behind the receiving slit. A lead shield protects the Geiger counter from direct β- and γ-radiation of the active sample. Specimens of activity 60 millicuries were successfully examined. J.Adam

548.734.3

1750. A COMPARISON OF X-RAY WAVELENGTHS FOR POWDER DIFFRACTOMETRY. W.Parrish and T.R.Kohler.
J. appl. Phys., Vol. 27, No. 10, 1215-18 (Oct., 1956).

Comparative diffractometer measurements were made with several radiations and a NaI(Tl) scintillation counter with pulse-height discrimination. Figures of merit for the different wavelengths based on intensity and peak-to-background ratio of a silicon powder specimen were: CuKα 100, MoKα 32, CrKα 10, and WLα 6. Several factors contributing to the figure of merit are discussed. A.

548.734.3

1751. PRECISION MEASUREMENTS OF UNIT CELL DIMENSIONS OF POLYCRYSTALLINE SAMPLES USING AN X-RAY BACK-REFLECTION CAMERA OF HIGH RESOLVING POWER. M.A.Gurevich and B.F.Ormont.
Zh. tekh. Fiz., Vol. 26, No. 5, 1106-12 (1956). In Russian.

Description of camera and thermostat is given. To avoid using a calibrating substance the authors advocate altering the specimen-to-film distance by an accurately known amount and taking two exposures in a sector cassette. J.Adam

548.735

1752. ON THE UNRELIABILITY OF THE "RELIABILITY" INDEX. J.Donohue and K.N.Trueblood.
Acta cryst., Vol. 9, Pt 7, 615 (July, 1956).

The "reliability" index is not a trustworthy measure of correctness or of relative accuracy of different crystal structures. It is stressed as significant that structural abnormalities are present in most of the incorrect structures cited in the paper. J.Adam

548.735

1753. THE DETERMINATION OF THE X-RAY ATOMIC SCATTERING FACTORS IN CRYSTALS FROM EXPERIMENTAL DATA. U.Korhonen.
Ann. Acad. Sci. Fennicae AI, Paper 188, 11 pp. (1956).

It is shown that the earlier methods for determining the atomic scattering factors of the ions belonging to a crystal contain certain defects and that the only correct way is to calculate them from Fourier series representing the electron distribution of the crystal. Further a procedure based on the difference series method is described. By using this procedure one can avoid the error due to the breaking-off almost entirely, as seen from the numerical example calculated in this paper. A.

548.735

1754. DETERMINATION OF CRYSTAL STRUCTURES BY MEANS OF ANOMALOUSLY SCATTERED X-RAYS. R.Pepinsky and Y.Okaya.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 5, 286-92 (May, 1956).

See Abstr. 8411 (1955). The properties of the Patterson function of a noncentric structure with anomalously scattering atoms are considered; the imaginary part of this function shows vectors between anomalously scattering and normally scattering atoms. In this way the determination of noncentric structures is made much simpler; for the space-group P1 it is unambiguous; and absolute configurations can be obtained. A.R.Stokes

548.735.44 : 539.26

1755. THE THEORY OF THE SCATTERING OF X-RAYS BY MACROSCOPIC ISOTROPIC BODIES. V.N.Filipovich and E.A.Porai-Koshits.
Dokl. Akad. Nauk SSSR, Vol. 105, No. 5, 968-71 (1955). In Russian.

An expression for the probable radial density of scattering matter in an isotropic body (gas, liquid, amorphous solid, glass or polycrystalline powder) is deduced from the Fourier transform of the X-ray scattering. The expression is more general than that of Warren (Journal of the American Ceramic Society, Vol. 19, 202, 1936) and accounts for false detail deduced by several workers. A.L.Mackay

548.735.44

1756. PARTIAL FOURIER SYNTHESES AND THEIR APPLICATIONS TO THE SOLUTION OF CERTAIN CRYSTAL STRUCTURES. M.J.Buerger.
Proc. Nat. Acad. Sci., Vol. 42, No. 10, 776-81 (Oct., 1956).

548.735.6/.7

1757. AN X-RAY STUDY OF THE STRUCTURE OF A SODIUM CHLORIDE CRYSTAL GROWN BY THE KYROPOULOS METHOD. D.A.Jones and T.Smith.
Proc. Phys. Soc. B, Vol. 69, Pt 9, 878-84 (Sept., 1956).

An X-ray examination has been made of the crystallite structure of a sodium chloride crystal grown with a varying growth velocity by the Kyropoulos method. The crystallites are axial in form and their major misorientation corresponds to a rotation about the boule axis and varies little with growth rates between 0.04 and 0.6 cm hr^{-1}, though the cross-sectional area decreases. The structures found at the high-growth rates cannot be completely explained by the mechanism proposed by Teghtsoonian and Chalmers, as evidence of polygonized regions was obtained. A.

548.735.7 : 536.653

1758. X-RAY DIFFRACTION STUDIES OF "ACTIVE" MAGNESIUM OXIDE. D.K.Thomas and T.W.Baker.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R 1854, 6 pp. (1956).

Precise determinations of line broadening in the X-ray diffraction patterns of magnesium oxide have permitted correlation of the variation in "activity" (heat of solution) of different preparations with the mean crystallite sizes. The results are in agreement with those expected theoretically. A.

548.736.1

1759. ON THE X-RAY DIFFRACTION SPIKES OF DIAMOND. F.C.Frank.
Proc. Roy. Soc. A, Vol. 236, 168-74 (Oct. 9, 1956).

The X-ray diffraction "spikes" of diamond can be fully explained as being due to segregated (100) planes of impurity atoms, which fail to reveal themselves in small-angle diffraction because the increases in thickness and in number of electrons are just proportional to each other. The alloying element concerned appears to be silicon. A.

548.74

1760. ELECTRON DIFFRACTION INVESTIGATION OF SEMICONDUCTIVE PbTe LAYERS. A.Feltynowski, I.Glass and L.Grelewicz.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 11, 597-600 (1955).

PbTe layers vacuum-deposited on a cooled substrate show a simple cubic structure of lattice constant 3.33 A. The normal structure of crystalline PbTe is of the NaCl type with a lattice constant of 6.36 A. It is suggested that in the thin films Pb and Te ions occupy random positions in the lattice, thus halving the unit cell edge. Examination by electron microscopy shows the films to be structureless, but exposure to the electron beam causes crystallites to become visible. K.W.Plessner

548.74

1761. NEUTRON DIFFRACTION STUDY OF MANGANESE FERRITE. J.M.Hastings and L.M.Corliss.
Phys. Rev., Vol. 104, No. 2, 328-31 (Oct. 15, 1956).

Neutron diffraction patterns have been obtained for polycrystalline $MnFe_2O_4$ at 300°K and 4.2°K. The fraction of tetrahedral sites occupied by Mn^{+2} has been found to be 0.81 ± 0.03, indicating that $MnFe_2O_4$ has very nearly the normal spinel structure. The value 0.3846 ± 0.0003 has been assigned to the space-group parameter u. The observed magnetic scattering is consistent with the Néel model and with the measured saturation moment. A.

548.74

1762. NEUTRON DIFFRACTION IN THE STUDY OF CRYSTAL STRUCTURES. F.Mazzi.
Ricerca sci., Vol. 26, No. 7, 2126-34 (July, 1956). In Italian.

Equipment, theoretical basis, and experimental techniques for the study of crystal structures by means of neutron diffraction are briefly described. Analogies and differences regarding to X-ray diffraction are particularly emphasized. A summary is given of some neutron diffraction studies of particular structures. A.

GEOPHYSICS 55

550.371 : 550.38 : 537.591.5 : 523.75

COSMIC RADIATION AND SOLAR—TERRESTRIAL RELATIONSHIPS. See Abstr. 1025

550.38 : 523.038

ON COWLING'S THEOREM ON THE IMPOSSIBILITY OF SELF-MAINTAINED AXISYMMETRIC HOMOGENEOUS DYNAMOS. See Abstr. 1006

550.384

1763. ANALYSIS OF THE SINUSOIDAL-TYPE VARIATION OF THE MAGNETIC DECLINATION OF APRIL 11, 1954. K.Burkhart and E.Selzer.
Ann. Géophys., Vol. 11, No. 3, 353-9 (July-Sept., 1955). In French.

The examination of the magnetograms of 14 European stations, made evident the development of a vortex-type, semi-local perturbation of the ionosphere, in regions bordering the southern limits of the auroral zone. In this analysis the influence of possible vertical electric currents participating in the vortex, and the one of induced telluric currents, had to be set aside, but these approximations could not affect appreciably, at least in the case of the perturbation of the April 11, 1954, the fundamental characteristics of the results. This flow over Europe of electrical currents in vortex formation presents many similarities with the cyclones of the troposphere which, in particular, circle equally counter-clockwise. However, these cyclones last generally days and weeks, whereas the circular perturbations in the ionosphere are over in a much shorter length of time. A.

550.384

1764. SEASONAL CHANGES IN THE ELEVEN-YEAR VARIATION OF THE HORIZONTAL COMPONENT H OF THE EARTH'S MAGNETIC FIELD. P.Bernard.
Bull. astron. (Paris), Vol. 20, No. 1, 27-34 (1955). In French.

The 11-year variation of H has been calculated for several stations using monthly means for successive years. The seasonal variations of amplitude are compared with those of the wind speeds at those altitudes where the electrons, but not the ions, are prevented from moving perpendicular to the magnetic field. It is shown numerically that the 11-year variation of H may be attributed to these winds. A.

550.385 : 551.594.5

1765. THE ORIGIN OF MAGNETIC STORMS AND AURORAE. V.C.A.Ferraro.
Ann. Géophys., Vol. 11, No. 3, 284-304 (July-Sept., 1955).

Gives an account of the Chapman—Ferraro theory of magnetic storms and aurorae. After reviewing briefly the reasons in favour of a solar corpuscular theory, and the average characteristics of magnetic storms derived from the analyses of Chapman and Moos, the nature of such streams is discussed at some length, with special reference to its composition, geometry, and dimensions. The solar stream seems likely to consist mainly of protons and electrons and to advance in to the earth's field with a speed of the order of 10^8 cm/sec. It is shown that during this advance, surface currents are induced in the stream surface and that these shield the back of the stream from the geomagnetic field. Protons and electrons from the back of the stream are therefore undeflected by the field and overtake the particles in the surface layers of the stream, to form in turn a new surface. This will therefore be continually reformed by fresh particles from the back of the stream, and in this way the stream particles are able to advance further into the earth's field than would be the case if they were alone in the field. The stream surface is impervious to the magnetic tubes of forces of the geomagnetic field. These are therefore pushed forward by the stream surface, thereby increasing the magnetic field outself it. Near the earth this increase is identified with the increase of the horizontal force during the first phase. The increase will, moreover, begin suddenly and this affords a simple explanation of a sudden commencement of a magnetic storm. The main phase is attributed to a westward ring current round the earth. It is shown that, if this can be set up, it will be very stable and the decay of current extremely slow owing to the large electromagnetic inertia of the ring. This accords well with the observed slow recovery of the geomagnetic field after a storm Martyn's extension of the theory to polar disturbances and

aurorae is briefly reviewed. The chief feature of this is the recognition that a high potential difference exists across the ring enabling escaping charges from the unstable surface layers to be accelerated to speeds well above the streaming velocity of 10^8 cm/sec and be precipitated along the auroral zones. This accords well with the fact discovered by Meinel that the speed of protons entering the atmosphere during auroral displays may well be about 10^9 cm/sec. Alfven's theory is also briefly discussed. A.

551.463

1766. STUDY OF THE PENETRATION OF ULTRAVIOLET [RADIATION] IN THE SEA. J.Lenoble.
Ann. Géophys., Vol. 12, No. 1, 16-31 (1956). In French.

The radiation going vertically downwards is reduced at 1/10 of its surface value near 30 m of depth for 4000 A and near 10 m for 3200 A. The proportion of radiation scattered horizontally and vertically upwards is nearly constant in depth, decrease a little in the short wavelengths and is much variable from one to another day; the mean values, for the middle of the ultraviolet spectrum, are approximately 20% and 2% of the downwards radiation. These results are explained by the theoretical computations of Chandrasekhar. A.

551.463

1767. STUDY OF THE PENETRATION OF LIGHT IN THE SEA. A.Ivanoff.
Ann. Géophys., Vol. 12, No. 1, 32-44 (1955). In French.

Describes measurements of the extinction coefficient of seawater and the ratio of the light scattered upward to the light transmitted downward. The observations were carried out using a spectrograph operated in a self-contained underwater equipment. A method is developed allowing an estimate of the total absorption coefficient of seawater from the extinction coefficient in various depths. A.

551.463 : 535.51

1768. FACTOR OF POLARIZATION OF SUBMARINE RESIDUAL DAYLIGHT. A.Ivanoff.
Ann. Géophys., Vol. 12, No. 1, 45-56 (1956). In French.

Preliminary measurements of the degree of polarization of submarine daylight were carried out photographically at 20 m depth, after an estimate of the contrast of the interference pattern given by a Savart plate. The percentage polarization was found to be on average of 10 vertically upward, 15 horizontally face to the sun, 30 horizontally back to the sun and 35 horizontally at right angle to the sun. The accuracy is about 20%. A.

ATMOSPHERE. METEOROLOGY 551.5

551.508.71 : 551.574.1

1769. THE PHOTO-ELECTRIC NUCLEUS COUNTER AS HYGROMETER. P.J.Nolan and T.C.O'Connor.
Geofis. pura appl., Vol 31, No. 2, 32-6 (1955).

Hygrometric measurements on room air were made with a Nolan-Pollak nucleus counter from which the lining of blotting paper had been removed. The dew point can be determined from the critical overpressure for condensation on nuclei. Satisfactory agreement with the values given by a ventilated wet and dry bulb hygrometer was obtained. The correction required is small since condensation occurs on ordinary atmospheric nuclei when the temperature is brought to about 0.3° C below the dew point. A.

551.508.91 : 551.574.1

1770. A NEW CONDENSATION NUCLEI COUNTER WITH CONTINUOUS OVERSATURATION. W.Holl and R.Mühleisen.
Geofis. pura appl., Vol. 31, No. 2, 21-5 (1955).

By mixing atmospheric air, saturated water vapour and hydrochloric acid a water vapour supersaturation corresponding to that in the Scholz nucleus counter is formed. The density of the fog formed is reproducibly related to the number of condensation nuclei per cm^3 and can easily be measured by photocells. A.

551.508.91 : 551.574.1

1771. A PHOTO-ELECTRIC CONDENSATION NUCLEUS COUNTER OF HIGH PRECISION. L.W.Pollak and T.C.O'Connor.
Geofis. pura appl., Vol. 32, No. 3, 139-46 (1955).

A new model of the direct-beam photoelectric condensation nucleus counter and its properties are described. The main feature of the construction is the reduction of the fog-tube diameter which resulted in the complete elimination of all uncertainties in the measurement of the light intensity after the fog is formed by adiabatic expansion. Individual measurements with two identical counters of this design which incorporate all previous improvements, agree to better than 5% in 70% of all cases, their average absolute difference being 2%. Deviations of more than one division of meter readings (or 10% of concentration) were not observed. This agreement is maintained over long periods. A calibration curve of the latest model of the photoelectric nucleus counter is given. A.

551.508.99

1772. THE DETECTION OF CHLORINE-39 IN RAIN WATER. L.Winsberg.
Bull. Res. Coun. Israel, Vol. 5A, No. 2-3, 143-6 (Jan.-April, 1956).

The discovery of chlorine-39 in rain water offers a new means of studying problems in cosmic radiation and meteorology. For this purpose it is necessary to make meteorological measurements and improve the method of sample collection, chemical purification, and counting. Suggestions along this line are given. A.

551.510.4

1773. OBSERVATIONS OF ATMOSPHERIC OZONE DURING A TOTAL ECLIPSE OF THE SUN. E.M.Fournier d'Albe and S.I.Rasool.
Ann. Géophys., Vol. 12, No. 1, 72-4 (1956). In French.

Observations by Dobson spectrophotometer during the total solar eclipse of June 30, 1954, failed to reveal any significant changes during the eclipse. This result is compared with observations of a rapid increase of ozone amount after sunset, and a tentative explanation is put forward of this discrepancy. A.

551.510.41

1774. ON THE ORIGIN OF THE ATMOSPHERIC ARGON. M.Nicolet.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 42, No. 5, 482-98 (1956). In French.

Most of the radiogenic argon took part in the formation of the atmosphere in the period preceding the time at which differentiation of the mantle and crust was sufficiently accomplished. Argon was one of the first constituents of the terrestrial atmosphere and has acted from the very beginning as a screen for X-rays and ultraviolet radiations at wavelengths less than 800 A. A.

551.510.41

1775. INFRARED EVIDENCE FOR ATMOSPHERIC OZONE AT SEA LEVEL. J.H.Taylor and H.W.Yates.
J. Opt. Soc. Amer., Vol. 46, No. 11, 998 (Nov., 1956).

Using a multiple C-arc as light source, NaCl prism monochromator, and thermocouple receiver, O_3 has been detected in a 10 mile path over seawater at an atmospheric concentration of 2.6 parts per 100 million, or equivalent pathlength of 0.42 mm O_3. D.R.Barber

551.510.535

1776. IONOSPHERIC OBSERVATIONS CARRIED OUT DURING THE SOLAR ECLIPSE OF JUNE 30, 1954, AT FRIBOURG. R.Busch, E.Harnischmacher and K.Rawer.
Ann. Géophys., Vol. 12, No. 1, 1-15 (1956). In French.

The variation of the electron density of the E-layer corresponds to a law with the 0.6 power of the radiation, the same as obtained from the normal daily variation. The absorption figures must be interpreted as the result of a decreasing D-layer absorption plus a selective E-layer absorption, the latter increasing during the eclipse. With this analysis a power-law with an exponent 1.1 is found for the non-deviative absorption. Oblique incidence observations also indicate an important decrease of D-layer absorption during the eclipse. A.

551.510.535

1777. FOCUSING ON A "RIPPLED" IONOSPHERE. K.Rawer.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 296 (May, 1956).

Addition to Abstr. 5770 (1955) giving expressions for the field strengths of multiple echoes reflected from a curved ionosphere and flat earth. The expressions may be applied to focusing effects due to ripples of spherical and cylindrical forms. G.M.Brown

551.510.535

1778. IONOSPHERIC ABSORPTION AT DAKAR. F.Delobeau and K.Suchy.
J. atmos. terrest. Phys., Vol. 9, No. 1, 45-50 (July, 1956). In French.

Monthly median and annual indices of both deviative and non-deviative absorption (with allowance for the earth's magnetic field) have been obtained at Dakar for the years 1951-4. Both indices show a correlation with sunspot number, which can be explained in terms of changes of D-layer ionization (for non-deviative absorption) and changes of E-layer height and hence collisional frequency (for deviative absorption). In the latter case a decrease of E-layer height of about 2 km per year over the years concerned is suggested. G.M.Brown

551.510.535

1779. TWO TYPES OF DEVELOPMENT OF THE E2 LAYER AT AHMEDABAD. R.G.Rastogi.
J. atmos. terrest. Phys., Vol. 9, No. 1, 71-2 (July, 1956).

Account of typical sequences of phenomena observed at Ahmedabad in the development of the characteristic E2-trace at 150 km. Illustrative ionograms are given. The E2-layer appears to be a normal one formed by photo-ionization by solar radiation. G.M.Brown

551.510.535

1780. REMARKS ON A PAPER OF G.W.G.COURT: "IONOSPHERIC WIND DETERMINATION FROM SPACED RADIO-RECEIVER FADING RECORDS". P.S.Pütter; G.W.G.Court.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 163, 163-4 (Aug.-Sept., 1956).

See Abstr. 8502 (1956).

551.510.535

1781. THE CALCULATION OF THE TRUE HEIGHTS OF REFLECTION OF RADIO WAVES IN THE IONOSPHERE. W.J.G.Beynon and J.O.Thomas.
J. atmos. terrest. Phys., Vol. 9, No. 4, 184-200 (Oct., 1956).

The calculation of the true heights of reflection of radio waves in the ionosphere from the variation of the virtual height of reflection with frequency is discussed for parabolic electron-density distributions. The existing theory is extended to include the case of reflections from contiguous parabolic sections or truncated parabolae, and a convenient basic expression is derived giving the variation of virtual height with frequency in terms of the layer parameters. It is shown that expressions developed by other workers are special cases of this more general expression. Methods are indicated whereby the true critical frequency of a truncated layer may be calculated in terms of the observed cusp frequency and it is shown that the analysis may be applied to give a rapid method of obtaining the layer parameters. A.

551.510.535 : 523.78

1782. THE RESPONSE OF THE IONOSPHERE TO THE SOLAR ECLIPSE OF 30 JUNE 1954 IN GREAT BRITAIN. C.M.Minnis.
J. atmos. terrest. Phys., Vol. 9, No. 4, 201-9 (Oct., 1956).

Vertical incidence measurements of virtual height and critical frequency were made at two points at which the maximum obscuration of the disk area was 93% and 74% respectively. The change with time in the intensity of the ionizing radiation during the eclipse was computed from the observed variation in f_0F1; from this change a model has been constructed giving the brightness distribution of the ionizing radiation over the sun's disk. 92% of the radiation was emitted from a uniformly bright disk on which were superposed, near the E and W limbs, small areas having about twice the brightness of the disk and, near the poles, similar areas having about half this brightness. Accurate measurements of the shape and height of the F2 layer are difficult owing to the proximity of f_0F1 and f_0F2, but an approximate analysis shows that no major changes in the height or thickness of the F2 layer accompanied the considerable fall in f_0F2 during the eclipse. It has not been possible to make any reliable estimates of α'_E or α'_{F1}. A.

551.510.535 : 538.566.3 : 523.3

F2-REGION DATA FROM MOON RADIO ECHOES. See Abstr. 1017

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.521.1

1783. SELECTIVE RADIATION. I. WAVELENGTH DISCRIMINATION. A NEW APPROACH TO THE HARNESSING OF SOLAR ENERGY. H.Tabor.
Bull. Res. Coun. Israel, Vol. 5A, No. 2-3, 119-28 (Jan.-April, 1956).

Initial experiments have shown that it is possible to produce surfaces which appear black but which have low emissivities at temperatures of a few hundred degrees C. Such selective surfaces should make possible the construction of solar energy devices of high efficiency with little or no optical concentration being required. A.

551.521.1

1784. SELECTIVE RADIATION. II. WAVEFRONT DISCRIMINATION. A NEW APPROACH TO THE HARNESSING OF SOLAR ENERGY. H.Tabor.
Bull. Res. Coun. Israel, Vol. 5A, No. 2-3, 129-34 (Jan.-April, 1956).

Because of the difference in form between direct solar radiation and thermal radiation from a heated body, it is possible, using optical principles, to construct a "solartrap" which will permit solar radiation to enter an enclosure whilst preventing thermal radiation from leaving it. Used as the cover of a flat plate solar energy collector, it provides a low effective emissivity and hence permits higher collection temperatures. A.

551.521.3

1785. SEPARATION OF THE COMPONENTS [CONTRIBUTING TO] THE REDUCTION OF LIGHT BY THE EARTH'S ATMOSPHERE. T.P.Toropova.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 295-8 (1956). In Russian.

Light reaching the earth's surface has in the main been reduced in intensity in the earth's atmosphere by three causes: (a) selective absorption by the gases of the atmosphere, (b) scattering of light by molecules and small particles of dimensions $\ll\lambda$, (c) scattering by larger particles, dry and wet aerosols. The above reduction can be determined by a previously described method of the author. Apart from the selective absorption the author assumes that the optical density of the atmosphere is made up of the sum of components due to molecular scattering, water vapour absorption or scattering, dry aerosol absorption or scattering. On some 10 days in the last quarter of 1954 the author checked his formula for the water vapour scattering coefficient against other standards methods, with most satisfactory agreement. As a result of experiments on some 6 days in the same period a formula was derived for the molecular scattering contribution to the optical density of the atmosphere. If the optical density of the atmosphere is measured and the water vapour and molecular scattering contributions subtracted from it the aerosol contribution is determined. Curves are given for the variation of the latter with λ on certain days. C.R.S.Manders

551.521.326

1786. SPECTROPHOTOMETRIC STUDY OF THE NIGHTGLOW OF THE MOLECULAR BANDS OF ATMOSPHERIC OH AND O_2. P.Berthier.
Ann. Géophys., Vol. 12, No. 2, 113-43 (1956). In French.

A preliminary part deals with the instrumental work and the use of the plates after their treatment, the photometric curves and the accuracy of the data. The study is divided into three parts: (1) diurnal and seasonal variations of the light intensity in the bands; (2) correlation between different components of the nightglow; (3) mean altitude of the emittive layers. A.

551.521.326

1787. INTENSITY VARIATIONS OF [OI] 5577 AND SODIUM D IN THE NIGHTGLOW. H.B.Pettit and E.Manring.
Ann. Géophys., Vol. 11, No. 4, 377-86 (Oct.-Dec., 1955).

From August 1953 to January 1955 an automatic photoelectric photometer has been in operation at Sacramento Peak, New Mexico (latitude N 32°47', longitude W 105°48', and elevation 9250 feet). Observations were made of [OI] 5577 and sodium D in the nightglow. The results of this study show: (1) The diurnal variation in intensity of [OI] 5577 takes three forms. About 54% of the nights have a maximum near midnight as normally observed by stations in mid-latitudes, 36% have a minimum near midnight as reported in the lower latitudes, and 10% have no appreciable fluctuation during the night. This seems to indicate that this latitude may represent a lower limit to a possible geographical zone of midnight nightglow maximum. (2) The sodium D observations at this station are remarkably similar to others made in mid-latitudes. (3) In comparing simultaneous observations made at two stations of different longitudes it is found that the average absolute intensities are much the same, but the diurnal variations are dissimilar in detail. A.

551.521.326

1788. ON THE HEIGHT OF THE ATMOSPHERIC LAYERS EMITTING THE LINES [OI] 5577 A, [OI] 6300 A AND NaI 5892 A. J.Dufay and M.-L.Tcheng.
Ann. Géophys., Vol. 11, No. 4, 387-419 (Oct.-Dec., 1955). In French.

The authors' former spectroscopic observations concerning the heights of the layers emitting the [OI] lines λ = 6300-6364 A at night and the sodium doublet are corrected. The altitude factor $K = J(70^0)/J(20^0)$ decreases in the average of 5% for the red OI lines and of 9% for the D line, increasing consequently the altitudes of the emitting layers. All the observations of the bright lines in the night sky spectrum are discussed again. Corrections for extinction and for the scattered light are made following the method of Barbier. Accounting only for the molecular scattering and for the absorption by atmospheric ozone, the following equivalent heights are obtained: λ = 5577 A, $z \cong 195$ km; λ = 5892 A, $z \cong 200$ (or 230) km; λ = 6300 A, $Z \cong 280$ km. But these heights may be reduced to 170; 170 (or 200) and 250 km respectively, if a thin layer of haze is present in the low atmosphere, producing, at the zenith, the additional optical density $D_0(v) = 0.0050$. Incertitudes arising from a selective absorption by water-vapour and by oxygen molecules and chiefly from the emission of the OH band are briefly considered. A.

551.521.326

1789. INSTRUMENTATION FOR NIGHTGLOW RESEARCH. P.St Amand.
Ann. Géophys., Vol. 11, No. 4, 435-49 (Oct.-Dec., 1955).

The general problem of photoelectric observation of the nightglow is discussed. The physical, optical and electronic aspects are discussed and the design of a new telescope for nightglow measurements is described. Suggestions for instruments suitable for use during the Geophysical Year are made. A.

551.521.326 : 551.510.535

1790. SOME POSSIBLE RELATIONS BETWEEN THE NIGHTGLOW AND THE IONOSPHERE. P.St Amand.
Ann. Géophys., Vol. 11, No. 4, 450-60 (Oct.-Dec., 1955).

Ionospheric data from Stanford, California is compared with nightglow data from Cactus Peak, California. The nocturnal variation of the brightness of the green line, 5577, of [OI] is found to be similar to the variation of height of the F-region. The nocturnal variation of the brightness of the red lines 6300-6364 of [OI] is found to be similar to that of the electron density of the F-region. The possibility that the red lines are produced by radiation following dissociative recombination of electrons with O_2^+ ions is discussed. A.

551.521.326

1791. THE VIBRATIONAL-ROTATIONAL BANDS OF THE OH MOLECULE IN THE INFRARED SPECTRUM OF THE NIGHT SKY. Y.Andrillat.
J. Phys. Radium, Vol. 17, No. 5, 442-8 (May, 1956). In French.

A survey of recent theoretical and observational work on the hydroxyl bands in the infrared spectrum of the nightglow out to 2 μ. A bibliography of 39 references is appended. D.R.Barber

551.521.326

1792. RESONANCE SCATTERING BY ATMOSPHERIC SODIUM. II. NIGHTGLOW THEORY. J.W.Chamberlain and B.J.Negaard.
J. atmos. terrest. Phys., Vol. 9, No. 4, 169-78 (Oct., 1956).

For Pt I, see Abstr. 9127(1956). The theory of radiative transfer is applied to the layer emitting the Na D lines in the nightglow. If the Na layer has an appreciable optical thickness τ_0 in the centre of the lines, resonance scattering will significantly affect the variation of intensity with zenith angle and the ratio D_2/D_1. Earlier quantitative discussions of this effect have neglected the scattered radiation and considered only one model for the nightglow layer. Three models are considered here: primary excitation concentrated at the bottom of the Na layer, evenly distributed through the layer, and concentrated at the top. Since there is considerable uncertainty both in the van Rhijn height of the layer and in the proper model for the nightglow, it is not feasible at the present time to deduce reliable information about the Na layer from a comparison of theory and observations. However, the van Rhijn heights and the ratio D_2/D_1 to be expected for the various assumed models and for a true height of about 85 km are discussed. Observations of the line ratio may prove valuable in ascertaining the nightglow model. A.

551.521.326

1793. RESONANCE SCATTERING BY ATMOSPHERIC SODIUM. III. SUPPLEMENTARY CONSIDERATIONS. D.M.Hunten.
J. atmos. terrest. Phys., Vol. 9, No. 4, 179-83 (Oct., 1956).

Two simple cases of resonant scattering of light by a line having the Doppler shape are considered. It is shown that an effective optical depth τ_e for the whole line can be found if the optical depth at the centre τ_0 is less than about 1. For different ranges of τ_0 the ratios $\tau_0/\tau_e = \sqrt{2}$, 1.5 or 1.6 are useful. Second, the excitation of the sodium emission in the night airglow is discussed. The Chapman mechanism may be quantitatively adequate; it leads to a strong concentration of the excitation towards the bottom of the sodium layer. A.

551.574.1

1794. CHARGED CONDENSATION NUCLEI FORMED IN A ROOM BY CORONA DISCHARGE WHEN ALTERNATING THE POLARITY OF THE CORONA POTENTIAL AND BY USING ALTERNATING CORONA POTENTIAL. R.Siksna.
Geofis. pura appl., Vol. 31, No. 2, 39-49 (1955).

The content of charged nuclei formed in a room varied by alternating the polarity of a corona device and depended on the period during which the corona of one polarity was switched on. The concentration of charges measured was greater during the negative period than during the positive one, when the action period of corona of one polarity was 30 minutes, but it was the opposite for the period of 5 minutes. When using alternating corona potential of 50 cycles per/sec only positively charged nuclei were established. By using alternating potential the picture was changed when air was blown through the corona device: the content of positively charged nuclei was diminished and negatively charged nuclei were also observed. An air circulation produced by the convection from an electric heater placed below the corona device was sufficient to cause a similar effect. A.

551.574.1

1795. DECAY OF AEROSOLS IN SMALL AND VERY SMALL VESSELS AND A STATIC METHOD FOR DETERMINING THE SIZE OF CONDENSATION NUCLEI. L.W.Pollak and T.C.O'Connor.
Geofis. pura appl., Vol. 31, No. 2, 66-79 (1955).

Experiments with this aim were made by G.Hentschel in 1954 using the "selective filling method" for size determination already applied by E.Effenberger. An analysis shows that the "selective filling method" is in effect the endeavour to determine the size of the nuclei from their changing concentration when stored in a miniature container. The problem is reduced to the question whether from the decreasing concentration or from the two coefficients of the decay law or one of them, the size of the nuclei can be deduced when they are stored in a closed vessel. This new procedure is called the static method for determining the size and mass of condensation nuclei. The advantages of the static method for investigating the atmospheric aerosol, particularly during aeroplane ascents and flights are as follows: Utilizing standard equipment it is possible to determine: (i) from two measurements of concentration the size of the nuclei, (ii) from three measurements of

concentration the size, density and mass of nuclei in contradistinction to the dynamic method which gives only averages covering periods of ten up to thirty minutes. A.

551.574.1

1796. ON THE THEORY OF DIFFUSION AND SEDIMENTATION OF CONDENSATION NUCLEI IN CYLINDRICAL CONTAINERS. R.Fürth.
Geofis. pura appl., Vol. 31, No. 2, 80-9 (1955).

The theory is given of a method for determining the diffusion coefficient D and the sedimentation velocity V of a suspension of uniform nuclei in a stationary gas contained in a cylindrical vessel with vertical axis and adsorbing walls. It is shown how D and V can be calculated from measurements of the total number N of particles in the container or the relative loss per unit time $\Lambda = -(1/N)(dN/dt)$ of this number for two different time intervals. From D and V the size, density and mass of the nuclei can be deduced. A.

551.574.1

1797. ON THE DETERMINATION OF THE DIAMETER DISTRIBUTION OF ATMOSPHERIC PARTICLES OF CHLORIDE BY THE LIESEGANG REACTION. O.Vittori A.
Geofis. pura appl., Vol. 31, No. 2, 90-6 (1955). In French.

A brief exposition concerning the general Liesegang reaction and the particular reaction photolytically sensitized for the detection of particles yielding in solution the ion Cl^- is first given. A description follows concerning systems employed for determining the ratio of the size of the chloride particle to the diameter of the corresponding ring. Some trials made by comparing one series of electron microscope measurements of particles obtained from NaCl vapour sublimation to the similar one of the ring values have not been considered valid, because the maximum of the distribution fell at nearly 0.2 μ and the sensitivity limit of the reaction might correspond to higher values. Single direct methods showed that the ratio can be considered constant, for one type of gelatine, within a few hours interval and that the ratio of the particle size to the ring diameter does not depend on the diameter of the first one. No difference is found between NaCl and $MgCl_2$ particles. As ratios, values ranging from 6.3 to 9.0, depending on the gelatine type, have been found. In this manner, submicroscopic particles are detectable. The methods employed are described and a brief summary of them given. A.

551.574.1 : 551.594.12

1798. ON THE EQUILIBRIUM OF IONISATION IN AIR CONTAINING NUCLEI. W.Holl and R.Mühleisen.
Geofis. pura appl., Vol. 31, No. 2, 115-18 (1955).

In the atmosphere on the outskirts of large cities the concentration of condensation nuclei and of the positive and negative small ions were measured simultaneously. It was possible to represent their connection by the formula $n \cdot M^{1/2.3} = \text{const}$. An interpretation of this formula from the behaviour of the condensation nuclei was attempted. A.

551.574.1 : 551.593.5

1799. ATMOSPHERIC TURBIDITY AND ITS SPECTRAL EXTINCTION. F.Volz.
Geofis. pura appl., Vol. 31, No. 2, 119-23 (1955).

The indices of the wavelength dependency of the haze extinction which were determined, in connection with nucleus size distribution studies, from measurements of solar radiation and visibility at Mainz, show pronounced seasonal variations. The summer values are in general definitely higher than in winter. There is no connection with the scattered light types of the sky-light or with the meteorological situation. A.

551.574.1

1800. THE RELATION BETWEEN THE CONCENTRATION OF ATMOSPHERIC CONDENSATION NUCLEI AND OTHER METEOROLOGICAL ELEMENTS AT VALENTIA OBSERVATORY. S.McWilliams and W.A.Morgan.
Geofis. pura appl., Vol. 31, No. 2, 129-46(1955).

Measurements of the concentration of condensation nuclei made twice daily (0h and 12h GMT) with a Nolan–Pollak photoelectric counter at Valentia Observatory, in the extreme South-west of Ireland, over the 4 years 1951-1954, are analysed to show relation with other meteorological elements. It is found that concentration at 12h is generally higher than at 0h and that precipitation at the time of observation or in the preceding hour reduces concentration between 40% and 50%. From measurements made when there was no precipitation at the time or in the previous hour it is found that concentration decreases with increasing wind speed but does not vary appreciably with wind direction apart from a sector from which pollution could be expected. High concentrations are found with visibility below 7 miles, with inversion of temperature, and, at 12h, with low cloud amount. The annual variation of concentration of nuclei, when free from the effects of pollution, follows fairly closely that of duration of bright sunshine. A.

551.574.1

1801. RESULTS OF RECORDINGS OF THE NUMBER OF CONDENSATION NUCLEI IN BASLE AND ITS IMMEDIATE NEIGHBOURHOOD. M.Bider.
Geofis. pura appl., Vol. 31, No. 2, 147-61 (1955). In German.

The influences of changes of air masses, of sunshine and precipitation on nuclei concentration are studied. Furthermore the results of simultaneous recordings in the centre of the city and on the outskirts, as well as on the outskirts of the city and at a nearby village are thoroughly discussed. A further comparison between Basle and Payerne shows connections between daily means of nuclei concentration of these two towns, which are about 100 km apart. A.

551.574.1 : 551.594.1

1802. CONDENSATION NUCLEI AS A CONNECTING LINK IN ATMOSPHERIC-ELECTRICAL/METEOROLOGICAL RELATIONSHIPS. H.Israël.
Geofis. pura appl., Vol. 31, No. 2, 162-8 (1955). In German.

The electrical effects of the weather phenomena can be interpreted partly as "variable elements of connections" partly as "generators" in the atmospheric electrical circuit. The various possibilities are discussed and represented by the equivalent wiring diagram. The condensation nuclei are thus shown to be an essential link between atmospheric electrical and meteorological relationships as is shown from some results of investigations carried out in high mountains (Jungfraujoch). According to radio-sonde measurements of the atmospheric-electric field made by Königsfeld the greatest variability of the field occurs at an altitude of a few km, which is to be interpreted as the effect of the vertical mass exchange on the content of condensation nuclei in various heights. A.

551.574.1

1803. SOME AIRBORNE OBSERVATIONS OF CONDENSATION NUCLEUS CONCENTRATION. G.J.Day.
Geofis. pura appl., Vol. 31, No. 2, 169-81 (1955).

The measurement of condensation nucleus concentration from an aircraft is considered, and preliminary observations made with a photoelectric condensation nucleus counter are discussed. It is concluded that at heights up to 6000 ft concentrations of condensation nuclei vary from 200 cm^{-3} in clean maritime air to 5×10^3 cm^{-3} generally over large industrial areas and 35×10^3 cm^{-3} downwind of specific industrial sources. It appears that sea spray makes a contribution to the nucleus population. A.

551.576/.577 : 541.182

1804. ASPECTS OF TRAVEL AND DEPOSITION OF AEROSOL AND VAPOUR CLOUDS. A.C.Chamberlain.
Atomic Energy Res. Establ. (Harwell) Rep. No. HP/R 1261, 35 pp. (1955).

In Pt I the various ways in which aerosols and vapours are deposited on surfaces are reviewed. Calculations are made of the rate of wash-out in rain. In Pt II Sutton's equations for the diffusion of clouds from ground level and elevated sources are considered, and it is shown how the equations can be modified to take deposition into account. Values of deposition parameters which give maximum deposition at given distances from ground level sources are obtained. A.

551.577 : 551.49 : 539.155.2

THE DETERMINATION OF TRITIUM IN NATURAL WATERS. See Abstr. 1529

551.594.1

1805. ON THE DIURNAL VARIATION REGIME OF THE POTENTIAL OF THE NORMAL ATMOSPHERIC ELECTRIC FIELD, AT MESSINA. S.Gandolfo.
Ann. Geofis., Vol. 8, No. 3, 315-24 (1955). In Italian.

551.594.14

1806. PRODUCTION OF Be^7 IN THE ATMOSPHERE. A.J.Cruikshank, G.Cowper and W.E.Grummitt.
Canad. J. Chem., Vol. 34, No. 3, 214-19 (March, 1956).

The concentration of Be^7 in the atmosphere has been determined by measuring the activity associated with dust particles in ground-level air. It is calculated that the observed concentration is maintained by a production rate of 2300 atoms Be^7/cm^2 per day in northern latitudes. A.

551.594.14

1807. ANNOTATED BIBLIOGRAPHY ON NATURAL AND ARTIFICIAL RADIOACTIVITY IN THE ATMOSPHERE. G.Thuronyi.
Meteorol. Abstr., Vol. 7, No. 5, 616-81 (May, 1956).

The primary subject of this bibliography is the artificial radioactivity in the atmosphere, originating from atomic or thermonuclear explosions. In addition to this principal subject, several peripheral fields such as the nonradioactive effects of nuclear weapons, natural radioactivity in the atmosphere and the use of radioactivity in other disciplines (tracer techniques, radioactive dating methods, instruments using radioactive elements) have been included. The bulk of the material has naturally been taken from the literature of the last decade. Only a very few representative papers have been chosen from the earlier literature. A.

551.594.14 : 539.172.4

1808. RADIOACTIVE PRECIPITATIONS IN ISTANBUL AND ULUDAĞ (TURKEY). S.Akpinar and R.Akpinar.
Rev. Fac. Sci. Univ. Istanbul C, Vol. 20, No. 4, 287-302 (Oct., 1955).

Results of observations on atmospheric radioactivity of fission origin for the period mid-June 1953 until end of June 1955 are presented. A.

551.594.2

1809. THE LOCATION OF THUNDERSTORMS BY A SINGLE-STATION HIGH-FREQUENCY RANGING TECHNIQUE. C.Clarke and B.J.Byrne.
J. atmos. terrest. Phys., Vol. 9, No. 4, 210-28 (Oct., 1956).

By observing the signal radiated by a lightning discharge on a number of frequencies in the high-frequency band, and measuring the maximum usable frequency, the range of the source may be found from a knowledge of the ionospheric conditions. By measuring simultaneously the direction of arrival of the signal, using a low-frequency cathode-ray direction finder operating on 10 kc/s, the position of the storm is determined. A preliminary investigation of the technique (Abstr. 9852/1954), has been extended by a more thorough investigation of the influence of ionospheric conditions and by improvements in the method of observation. It is necessary to know which layer is controlling the propagation and, in the case of F2, to know also the height and thickness of the layer. Outside the sunset and sunrise periods, the E and F1 conditions may be calculated sufficiently accurately from the zenithal angle of the sun; the F2 conditions are derived from the predicted critical frequencies and M.U.F. factors. Range measurement appears to be impossible when propagation is controlled by sporadic E ionization. Observations made during the summer of 1954 are compared with the thunderstorm positions given by the Meteorological Office network of direction finders. Some of the measurements were made in conjunction with backscatter observations for determining the ionospheric conditions. It is concluded that the system provides a possible technique for the location of thunderstorms within 500-2000 km of a single observing station, for about 70% of the time. Apart from four months around midwinter, it is essential to have backscatter equipment to provide continual monitoring for Es propagation. An accuracy of 10% in range should be obtained at 1000 km under good conditions. A.

551.594.5

1810. RADIO ECHOES FROM AURORAE. T.R.Kaiser and K.Bullough.
Ann. Géophys., Vol. 11, No. 3, 279-83 (July-Sept., 1956).

Analysis of the radio-echo auroral observations made at Jodrell Bank during the years 1950 to 1953 enables a systematic picture of the spatial distribution and motion of the reflecting ionization to be built up. The results are compared with visual-auroral and magnetic data. A.

551.594.6 : 537.591.5 : 523.745

1811. SUDDEN ABSORPTION OF ATMOSPHERICS DUE TO INCREASE IN COSMIC RAY INTENSITY. J.Aarons and W.R.Barron.
Nature (London), Vol. 178, 277-8 (Aug. 4, 1956).

Atmospheric noise studies on 49 kc/s at Fourth Cliff, Mass., indicated a sudden drop in signal level some 10 min after the solar flare of Feb. 23, 1956 (2244 L.T.) which is considered to have been produced by the cosmic-ray increase (noted a few minutes later) rather than any ultraviolet effect. G.M.Brown

BIOLOGY 57/59

578.08

1812. PREPARATORY AND AIR-DRIVEN MICROMANIPULATORS FOR ELECTROPHYSIOLOGY. G.v.Békésy.
Rev. sci. Instrum., Vol. 27, No. 9, 690-2 (Sept., 1956).

A method is described, which facilitates the carrying out of anatomical or physiological preparations that are extremely delicate to handle with free hands. It consists mainly in a support and a screwdriver acting as a lever to reduce the movements of the hands. For very fine micromanipulations, where even touching the operating table must be avoided, an air-driven micromanipulator has been built, in which a small air-driven turbine rotates the adjusting screws of the manipulator. Movement in various directions can be performed by pressing keys which open air pressure valves. All the movements can be programmed in advance by means of prepunched holes in a paper strip of the type used in teletype systems. A.

MEDICAL SCIENCE.

HUMAN PHYSIOLOGY 61

612.171.1

1813. BALLISTOCARDIOGRAPHIC INSTRUMENTATION. H.W.Lewis, D.H.Smith and M.R.Lewis.
Rev. sci. Instrum., Vol. 27, No. 10, 835-7 (Oct., 1956).

An analogue method is described for solving some of the mechanical problems associated with the recording of ballistocardiograms. An LCR circuit is used as the analogue of the body coupled to a fixed table. It is concluded that no technical obstacles exist to the widespread use of ballistocardiography, through equipment similar to that described here. Clinical problems in the interpretation are not discussed. A.

612.843

1814. SOME REMARKS ON CIRCUITS FOR ELECTRORETINOGRAPHS. T.Fazzini.
Atti Fond. Ronchi, Vol. 11, No. 2, 175-80 (March-April, 1956). In Italian.

The author examines the characteristics required by a circuit in order to obtain reliable records of the electrical response of the human eye to light. A.

612.843.16

1815. LUMINANCE–DURATION RELATIONSHIP IN THE ELECTRIC RESPONSE OF THE HUMAN RETINA. M.Alpern and J.J.Faris.
J. Opt. Soc. Amer., Vol. 46, No. 10, 845-50 (Oct., 1956).

Measurements of the magnitude of the a and b waves of the human electroretinogram on the right eye of one dark adapted observer have been carried on over a range of durations [5 to 143 msec] and retinal illuminances [2.61 $(10)^6$ to 2.61 $(10)^2$ trolands] of the stimulating flash. The results have been analysed in terms of their implications for photochemical theory of the voltage generation in the electroretinogram as well as for the theory of metacontrast. A.

PHOTOGRAPHY 77

771.534

1816. RECORDING MICROPHOTOMETER WITH A LINEAR DENSITY SCALE. F.Valentin.
J. Phys. Radium, Vol. 17, No. 6, 8 S-10 S (June, 1956). In French.
Describes a photographic-recording microphotometer which employs a photomultiplier with log output as receiver. The relation between output current and density is essentially linear over the working range of normal spectrograms. D.R.Barber

771.534

1817. LARGE INCREASE OF LIGHT SENSITIVITY AT LOW TEMPERATURES FOR CERTAIN TYPES OF X-RAY FILM.
K. Lonsdale and H.J.Grenville-Wells.
Brit. J. appl. Phys., Vol. 7, No. 10, 380 (Oct., 1956).
With the same exposure to light at 15°C and at −95°C, Ilford Industrial G film gave densities of 0.08 and 1.34 respectively. The effect was most marked for long exposures to low intensities. Some other types of film showed a smaller increase in sensitivity and some showed a decrease. No increase in sensitivity to X-rays of ordinary diffraction wavelengths was found. A.R.Stokes

771.534

1818. ON THE PHENOMENA OF PHOTOGRAPHIC REVERSAL. PHOTOGRAPHIC REVERSAL BY THE SIMULTANEOUS ACTION OF LONG AND SHORT WAVELENGTH LIGHT. E.A.Galashin and V.M.Tatevskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 347-50 (1956). In Russian.
Reversal ("solarization") is found to take place for visible light at all wavelengths [see also Sauvenier, Abstr. 7829/1952]. Exposure for various times to a mixture of red and violet light after different pre-exposures to white light indicate a gradual transition from solarization to the Herschel effect. W.O.Lock

771.535

1819. ON THE REARRANGEMENT OF THE LATENT IMAGE BY THE PHOTOGRAPHIC ACTION OF IONIZING PARTICLES.
A.L.Kartuzhanskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 285-8 (1956). In Russian.
Let one crystal have N sensitivity centres each requiring n_0 Ag atoms to be rendered developable and let n Ag atoms be formed by the ionizing particle. It is shown that if the rearrangement of the Ag atoms occurs at random then the certain existence of centres having at least n_0 Ag atoms can be expressed by $n \geq N(n_0 - 1) + 1$. Data in agreement with this relation are given and discussed. W.O.Lock

778.33 : 535.822

1820. AN INTERMEDIATE FORM OF CONTACT-MICRORADIOGRAPHY AND PROJECTION-MICRORADIOGRAPHY. J.B.Le Poole and Ong Sing Poen.
Appl. sci. Res. B, Vol. 5, No. 6, 454-8 (1956).
It is shown that in projection microradiography it is advantageous to use a magnification 2. The gain in intensity and ease of operation is discussed. A.

778.33

1821. MICRORADIOGRAPHY.
Brit. J. Radiol., Vol. 28, 517-42 (Oct., 1955).
I. MICRORADIOGRAPHY: A REVIEW. A.Engstrom, S.Bellman and B.Engfeldt (517-32).
The various types of microradiography are outlined. The use of contact microradiography in histochemical analysis is described, with reference to normal and pathological calcified tissues. Visualization of the fine blood vessels in living tissue is also possible. Recent techniques in X-ray microdiffraction are discussed.
II. PROJECTION MICRORADIOGRAPHY. W.C.Nixon and V.E.Cosslett (532-6).
The principles of the method are outlined, together with an experimental form of apparatus in which manipulation of the specimen is possible. Results indicate that this approach has great potential value in medicine and biology.
III. A SEALED-OFF X-RAY TUBE FOR CONTACT-MICRORADIOGRAPHY. B.Combee, J.Houtman and A.Recourt (537-42).
The construction of a compact sealed-off tube for 3 kV X-rays and of intensity suitable for contact microradiography is described. R.Reed

778.33

1822. XERORADIOGRAPHY.
Brit. J. Radiol., Vol. 28, 543-51 (Oct., 1955).
I. APPARATUS AND METHOD OF USE. W.D.Oliphant (543-4).
The experimental apparatus described uses amorphous Se as sensitive layer which can be charged uniformly by exposure in the dark to a corona discharge from a suitably shaped electrode. The modification of charge during exposure to X-rays in a manner depending on the incident radiation, constitutes a latent image which is "developed" by a method of depositing powder in proportion to the charge density. Resolution depends on the size of the powder particles. On a test card, distinct reinforcements along dividing lines between black and white are visible, indicating the high contrast obtainable with xerographic images.
II. THE PRESENT MEDICAL APPLICATIONS. T.H.Hills, R.W.Stanford and R.D.Moore (545-51).
Several comparisons between conventional and xeroradiographs are presented critically. Results of varying plate-charging time, X-ray exposure, and powder development time are shown and discussed. The much larger X-ray exposures necessary at present limit the use of even experimental xeroradiography to extremities and small thicknesses. Speed of development time without necessity of the darkroom, ease of transferring results to 35 mm film, and the possibility of controlled exaggeration of image detail, are advantages which may lead to development of the process for routine use. D.V.Mabbs

778.33

1823. EXPERIMENTAL COLOUR RADIOGRAPHY.
A.Bryce.
Brit. J. Radiol., Vol. 28, 552-3 (Oct., 1955).
Negative and positive lantern plate transparencies are taken from a radiograph and these are enlarged separately on to colour printing paper, each being exposed through a different filter. The result is a two-colour print of the radiograph, the aim being to represent the light tones of the original in one colour and the dark tones in another. Direct radiographs have also been made, with and without intensifying screens, using colour printing paper. D.V.Mabbs

778.33

1824. RADIOGRAPHY WITH THULIUM 170 AND XENON 133.
W.V.Mayneord and H.J.D.Ireland.
Brit. J. Radiol., Vol. 29, 277-85 (May, 1956).
The limitations in the use of these isotopes for medical radiography are discussed. Tm^{170} gives 85 kV gamma-rays and also bremsstrahlung of 150 kV which reduces contrast and adds to the source shielding problem. Xe^{133} (81 kV gamma-rays) gives no bremsstrahlung but is limited by short half-life (5.3 days) and the difficulty of adsorbing the gas on to small charcoal pellets. In either case the source size is limited to about 1 mm. At the short distance needed for practical exposures (e.g. 10 cm, 45 sec for a hand) the quality of radiograph is inferior to that from X-rays, though portability and independence of mains are important advantages. F.T.Farmer

778.33 : 77.023.4

1825. AN ADVANCE IN X-RAY FILM PROCESSING.
R.W.Stanford and T.H.Hills.
Brit. J. Radiol., Vol. 29, 286-94 (May, 1956).
Automatic control of developer in a processing machine is shown to be satisfactory if based on bromide concentration. Each film normally releases approximately 0.25 g bromide into the developer and carries away, as liquid, 0.1 g, and the balance is maintained by adding a fixed amount of bromide-free developer per film. Excellent reproducibility of films over 3 years is achieved, and the changes in film characteristics resulting from any slight changes in conditions are analysed in detail. F.T.Farmer

778.33

1826. THE IMPROVEMENT OF DEFINITION BY X-RAY IMAGE MAGNIFICATION. A.Nemet and W.F.Cox.
Brit. J. Radiol., Vol. 29, 335-7 (June, 1956).

An equation for effective blurring (B_e) of a fluoroscopic X-ray image is presented in terms of screen blurring, magnification (M) and size of tube focus. Differentiating with respect to M shows that there is an optimum value of M for which B_e is a minimum. Curves are plotted from the equation using appropriate constants. In general, it is demonstrated that, with a fine-focus X-ray tube (0.3 mm) a useful reduction in blurring can always be obtained by using magnification either with a normal fluorescent screen or with an image intensifier.
D.V.Mabbs

778.33 : 539.165

1827. QUANTITATIVE BETA TRACK AUTORADIOGRAPHY WITH NUCLEAR TRACK EMULSIONS. H.Levi and A.S.Hogben.
K. Danske Vidensk. Selsk., mat.-fys. Medd., Vol. 30, Paper 9, 23 pp. (1955).

The applicability of the nuclear track plate NTB-2 (of Eastman Kodak, Rochester, N.Y.) to quantitative beta track autoradiography has been investigated. A constant source of C-14 beta-particles was brought in contact with the emulsion and the number of tracks registered per unit area of the plate was counted. The counting results obtained by four different investigators evaluating a total of 50 images were subjected to statistical analysis. The reproducibility of the track count was studied, both with respect to the counting ability of one and the same investigator repeatedly confronted with a given track pattern, and to the evaluation of the same pattern by different investigators. A statistical analysis of the counting results permits one to estimate the homogeneity of the emulsion in small areas of the plates, to compare the homogeneity of plates from the same batch, and their sensitivity from batch to batch. The efficiency of the plates and the effect of storage conditions have likewise been investigated. The contributions of various sources of error to the uncertainty of the final counting results were estimated. A.

778.33 : 535.822 : 537.531

1828. MICROSCOPY WITH X-RAYS. V.E.Cosslett.
Nature, Vol. 178, 676-7 (Sept. 29, 1956).

Brief report of a symposium held at the Cavendish Laboratory, Cambridge, Aug. 16-21, 1956.

778.33

1829. INTENSIFYING SCREENS FOR AUTORADIOGRAPHY. M.Ageno.
R.C.Ist. Super. Sanità, Vol. 18, Pt 5, 329-32 (1955). In Italian.

The results are set out of some tests carried out to obtain a reduction of exposure times in autoradiography by the use of fluorescent intensifying screens. A.

778.34

1830. APPLICATION OF THE HERSCHEL EFFECT FOR SELECTIVE ERASING OF BACKGROUND IN NUCLEAR EMULSION. L.Jarczyk and Z.Lewandowski.
Acta. phys. Polon, Vol. 15, No. 2, 143-5 (1956).

The effect of exposing emulsions to infrared light has been examined as a function of time. The density of background grains is found to be appreciably reduced, there being an optimum time of exposure of about 50 min depending on the grain density of the track under investigation; further exposure reduces the signal/noise ratio. With α-particles continued irradiation eliminated the background to such an extent that the ratio increased by a factor of 5 for a 200 min exposure. The emulsions used were of the M2 type manufactures by the Wroclaw Institute of Technology.
D.J.A.Prowse

778.34 : 539.18

1831. PHOTO-ELECTRIC MASS DETERMINATIONS IN NUCLEAR EMULSIONS. IV. DETERMINATIONS OF K-PARTICLE MASSES. K.Kristiansson.
Ark. Fys., Vol. 10, Paper 33, 447-65 (1956).

For Pt III, see Abstr. 1437 (1955). Photometric measurements of the mass of K-particles stopping in nuclear emulsions are described. The paper discusses the method of measurement and the errors which normally appear in such mass measurements. The errors are eliminated as far as possible by accurate checking of the instrument and a suitable choice of the tracks used for comparison. The result of the mass measurements of six K-particles is $975 \pm 23\ m_e$, thus in good agreement with other mass determinations. A.

778.34 : 537.534.75

1832. THE GRAIN DENSITY OF PROTON TRACKS IN DILUTED EMULSIONS. G.Philbert.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 36-8 (July 2, 1956). In French.

The grain densities of low energy proton tracks caused by protons knocked-on by neutrons from the reaction $Be^8(d, n)B^9$, have been measured. It is found that the density as a function of the rate of loss of energy is well represented by an equation of the form: $dN/dR = c\{1 - \exp(-b(dE/dR)^{1/2} - a^{1/2})\}$, first proposed by Morand and van Rossum. D.J.A.Prowse

778.34

1833. AN ALINEMENT AND CO-ORDINATE SYSTEM FOR NUCLEAR EMULSION STACKS. E.Silverstein and W.Slater.
J. sci. Instrum., Vol. 33, No. 10, 381-3 (Oct., 1956).

Problems of scanning, trace-through and measurement in nuclear emulsion stacks can be simplified by the use of a co-ordinate system photographed directly on to the face of each pellicle. A method of making and printing a suitable grid that intercepts less than $\frac{1}{2}\%$ of the useful area, as well as the advantages arising from its use, are described. A.

778.34

1834. NOTE ON ALPHA PARTICLE STARS IN NUCLEAR EMULSIONS. A.C.Stanbury.
New Zealand J. Sci. Technol. B, Vol. 37, No. 6, 671-4 (May, 1955).

The examination of nuclear research plates exposed in New Zealand reveals close pairs of low-energy stars. The presence of these stars is shown to be consistent with the generally accepted view that the emulsions contain radioactive contaminants. Range measurements indicated that the events observed are consistent with the decay series of thorium. A.

778.34

1835. CURVATURE CORRECTION TO THE SAGITTA DISTRIBUTION OF IONIZATION TRACKS. H.Wergeland and H.Överaas.
Nuclear Physics, Vol. 1, No. 4, 304-7 (1956).

Scott's formula for obtaining the mean square deflection per unit length of track from measurements of the sagitta ($\bar{\theta}^2 = 96(\bar{Y}^2/L^3)$, L = chord length, Y = ordinate of mid-pt) has been modified to take the curvature of the track into account. The correction is found to be very small merely changing the constant 96, to π^4 (97.4). D.J.A.Prowse

778.34

1836. ON SEVERAL TECHNICAL PROBLEMS CONNECTED WITH THE USE OF NUCLEAR EMULSIONS IN EXPERIMENTS WITH ARTIFICIAL SOURCES OF RADIATION.
D.Carlson-Lee, C.Franzinetti and L.Tau.
Ricerca Sci., Vol. 25, No. 9, 2659-64 (Sept., 1955). In Italian.

Concerned with the development of nuclear emulsions, and the reduction and intensification of tracks in emulsions already developed, in attempts to differentiate quickly between different types of particles in the beams from large machines, and to reduce background from highly ionizing particles.
P.Rothwell

778.6

1837. ROLE OF CHROMATICITY DIFFERENCE IN COLOR GRAININESS JUDGMENTS. K.F.Stultz and D.A.Koch.
J. Opt. Soc. Amer., Vol. 46, No. 10, 832-7 (Oct., 1956).

It is known that, for black-and-white materials, the threshold "graininess" of a random pattern of dots on a background of a different luminance varies in a uniform manner with the difference between the log luminance of the dot and that of the background. For similar samples prepared with dots of one colour on a background of a different colour, it was found that this relationship does not hold. Data are presented showing that a correlation exists between ΔE and graininess, where $\Delta E = [(\Delta D)^2 + K(\Delta C)^2]^{1/2}$. Here, ΔD is the log luminance difference and ΔC the chromaticity difference (as measured on a uniform chromaticity scale) between the dots and the background. As a preliminary to the main experiment, the visual brightness of the 48 samples was measured for a 2^0 field, and the corresponding luminance values were computed. All the differences were erratic and were within the limits of experimental error. A.

LIST OF JOURNALS

The following list supplements the Lists of Journals published with the January number of Volume 56 (1953) and the Supplements published with the Indexes to Volumes 56 (1953), 57 (1954), 58 (1955) and 59 (1956). Copies of the numbers containing these lists can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

CEIG Ber. — CEIG Berichte.
Formerly: CEG Berichte.
Title changed commencing with Vol. 3, No. 1, 1957.

NEW JOURNALS

Nuclear Instrum. — Nuclear Instruments.
North-Holland Publishing Company, P.O.Box 103, Amsterdam; Interscience Publishers, 250 Fifth Avenue, New York 1, N.Y.
Bi-monthly. Vol. 1, No. 1 dated Jan., 1957.

Suppl. Mem. Soc. Astron. Ital., Colloq. Astrofis. — Supplementi alle Memorie della Società Astronomica Italiana, Colloqui del Centro di Astrofisica del Consiglio Nazionale delle Ricerche.
Via Brera 28, Milan. No. 1 dated 1956.

ERRATA

June, 1956, p. 473 : abstract numbered 4058 should be 4358.
Abstr. 19 (1957) line 2 : add "III. Realization of the [aerial] systems."

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